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THE PHILIPPINE
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VOL. 3 JULY–DECEMBER, 1955 NO. 2

AVAILABILITY OF CALCIUM IN BAGOONG ALAMANG DRIED ALAMANG, CANNED BANGOS OYSTER SHELL, AND BALUT[1]

By SILVESTRE V. BERSAMIN, OLYMPIA N. GONZALEZ, and JOSE I. SULIT
Of the Bureau of Fisheries, Manila

ONE TEXT FIGURE

INTRODUCTION

Calcium occupies a prominent place in the human body's mineral composition. Since it is essentially useful in the maintenance of bones and teeth, most of it is found in the bony skeleton. It is not found in the same proportion in all foods. Many of the foods commonly liked by people are entirely lacking in calcium or contain small amounts of it. The Oriental diet is poor in calcium. This is typically true of the Filipino who generally lives on cereals, fish, and vegetables. Calcium-deficient diets have also been noted in the United States, England, Scotland, and other European countries (Bogart, 1949). This paper intends to acquaint the people with some food products which are good sources of available calcium. The products under investigation are common, cheap, and easily obtainable by the average family and thus would be considered good substitutes for milk which is an excellent source of calcium but an expensive item in the diet.

[1] This investigation was performed at the Bio-assay Laboratory of the Bureau of Fisheries at Dagatdagatan Experimental Station, Malabon, Rizal Province.

Bagoong alamang, a fermented semisolid paste obtained by salting small shrimps, is generally used as condiment for flavoring various vegetable, fish, and meat dishes. Dried alamang is a favorite of housewives for improving the flavor and rendering leafy vegetable dishes palatable. Balut,[2] considered a nutritious food among some Filipinos, is quite expensive but is a good source of protein and vitamins besides calcium. The bones from canned bañgos present another good source of available calcium. Oyster shell has not yet met extensive public demand as a source of calcium for poultry, fish, and other animal feed although it is cheap and easily obtainable.

Table 1 gives the chemical analysis of the foods used as sources of calcium in the experimental diets. This table shows that bagoong alamang and dried alamang contain appreciable amounts of calcium.

TABLE 1.—*Chemical analysis of dried alamang, bagoong alamang, canned bañgos, balut, and oyster shell.*

	Bagoong alamang	Dried alamang	Bañgos	Balut	Oyster shell
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Moisture	65.7	13.42	73.9	70.8	----------
Protein	12.3	59.33	20.3	14.4	----------
Fat	2.1	----------	4.5	12.4	----------
Ash	18.4	8.37	1.30	1.10	----------
Carbohydrates	1.5	----------	----------	0.9	----------
Calcium	2.071	3.33	2.75	0.117	46.84

REVIEW OF LITERATURE

Considering the fact that in the Philippines milk and other dairy products are luxury items in the diet, and that a comparatively large amount of calcium is necessary for optimum health, Navarro (1950) made experiments on the availability of calcium in two typical and widely used fish products, namely, salted fish paste (*bagoong*) and dried anchovies or *dilis* (*Stolephorus commersoni*). She found that the retention of calcium from dilis is approximately 90 per cent that of milk powder and only 62 per cent in bagoong.

Leverton and Payawal (1951) worked on the physiological availability of calcium, phosphorus, and nitrogen from the bones and flesh of dilis using human subjects. They reported that girls from 9½ to 13 years of age can utilize the calcium,

[2] Balut is an embryonated duck egg whose development is arrested by cooking.

phosphorus, and nitrogen from the bones and flesh of dilis as well as from milk.

Basu et al. (1942) performed calcium and phosphorus balance experiments in small fish bones using human subjects, and found that about 45 per cent of the calcium and 44 per cent of the phosphorus of small unboned fish was retained. They further emphasized that eating small fish complete with the bones as practiced in India, Philippines, and other Oriental countries increases the available calcium in the diet.

Feeding experiments on rats performed by Lunde and Like (1940) using fish, fish bones, and milk as sources of calcium revealed that the per cent utilization in milk, canned sardines, and fresh brisling were 93.8, 92.1, and 94.7, respectively. The U. S. Bureau of Fisheries also reported that the calcium in the bones of canned salmon is nutritionally available.

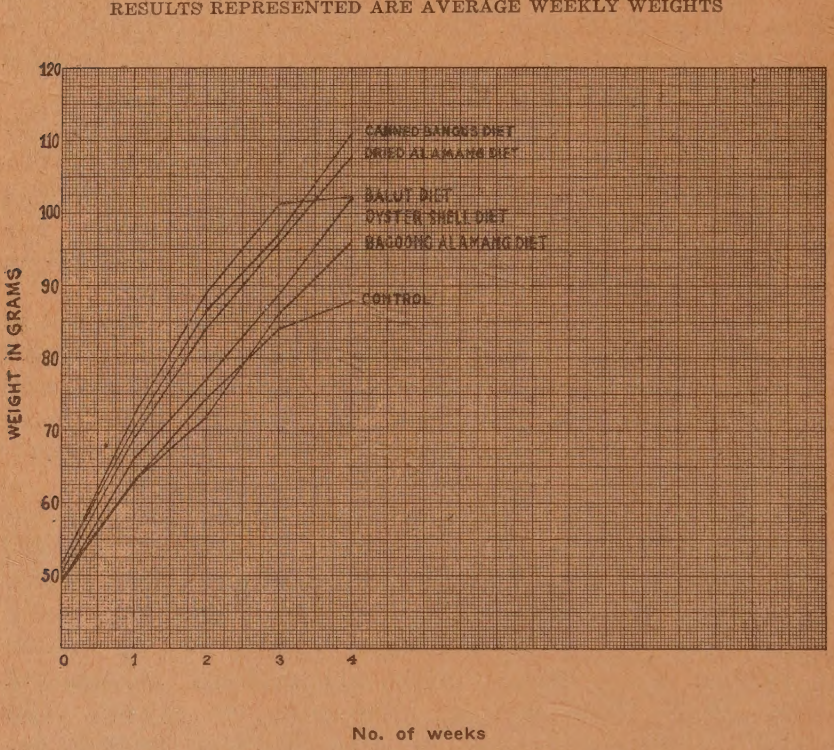
Drake et al. (1949) compared the utilization of calcium in skim milk powder and in bone meal by humans and concluded that the availability of calcium in bone meal is about the same as that of milk. They further found that the retention of calcium from whole cooked ground bones by rats was approximately 90 per cent over that from whole dried milk.

Other workers have also performed various bio-assay experiments on the availability of calcium in some typical foods. McCluggage and Mendel (1918) performed experiments which showed that the calcium of carrots and spinach are poorly utilized by dogs. In 1938 Fairbanks reported that the calcium in spinach is not utilized in the animal body. Adolph and Chen (1932) found that soy bean curd, the product from which the *tahu* and *tokua* of most Philipine markets are manufactured, is about equal to milk as a source of calcium.

EXPERIMENTAL PROCEDURE

This experiment utilized the procedure developed by Drake et al. (1949) on the utilization of calcium in bone meal by rats. Healthy albino rats, about 28 to 30 days old and weighing about 49.9 grams each, were selected for the assay. The rats were arranged so that litter mates of the same sex were matched and that the initial weights of each of the six groups in the experiment were approximately the same. The rats were placed in separate cages with raised screen bottoms under which paper towels were placed to prevent the loss of spilled food.

Calcium in the form of the substances to be tested was added to five of the experimental dietary groups. The sixth group containing a small amount of calcium probably due to the presence of casein in the diet, was used as control. A basal ration devised by Robertson and Doyle (1935) was used.



TEXT FIG. 1. Growth curve of rats fed with the different experimental diets.

This diet contained low calcium but the other elements like phosphorus were normal. The salt mixture used was devoid of calcium salts. The composition of the experimental diets together with their calcium contents is shown in Table 2.

Six groups containing 10 rats each were formed. Groups I to V were fed the experimental diets containing calcium in the form of bagoong alamang, dried alamang, canned bañgos, oyster shell, and *balut*. These products were dried thoroughly in an oven at 70°C., and then ground finely to pass through a No. 40 mesh sieve. After reduction to fine powder, they were mixed thoroughly with the basal rations. All the experimental rations were prepared in sufficient quantities to last

TABLE 2.—*Composition of diets and their calcium contents.*

Ingredients	Percentage of dietary rations					
	Bagoong alamang diet	Dried alamang diet	Canned bañgos diet	Oyster shell diet	Balut diet	Control diet
Casein	16.4	17.0	16.7	18.0	15.7	18.0
Cornstarch	56.7	58.7	57.6	61.7	54.1	62.2
Purico	9.1	9.4	9.3	10.0	8.7	10.0
Yeast	5.5	5.7	5.6	6.0	5.2	6.0
CLO	1.8	1.8	1.8	2.0	1.7	2.0
Salt mixture *	1.6	1.7	1.6	1.8	1.6	1.8
Bagoong alamang	8.9					
Dried alamang		5.7				
Canned bañgos			7.4			
Oyster shell				0.5		
Balut					13.0	
Calcium	0.178	0.208	0.306	0.147	0.086	0.04

* Salt mixture	Weight (*Gram*)	Weight (*Gram*)
H_2HPO_4		219.72
KCl		125.29
NaCl		77.41
$MgCO_3$		33.43
$MgSO_4$		38.50
KI	.30	
$K_2Al_3(SO_4)_4$. 24 H_2O	.67	
$MnSO_4$	1.17	
		13.80
NaF	3.68	
Fe citrate 1–1/2 H_2O	94.18	

the whole period of the experiment. They were placed in stoppered glass containers and kept under refrigeration.

The food and water were given *ad-libitum* for a period of four weeks, during which time an accurate record of the food consumed by each rat was taken. Any spilled food was saved and weighed to get the accurate amount of food eaten by each rat. The animals were weighed regularly every week. Close observations were made daily on the health and physiological behaviour of the experimental animals.

At the end of the assay period the final weights of the animals were taken, then they were killed with chloroform. All food adhering to the fur, tail, and other parts of the body was carefully removed. The rats were dissected through the abdominal cavity, and the stomach and intestines were discarded to eliminate the inclusion of food particles. According to Kao, Conner, and Sherman (1937) the calcium found in the walls of the intestinal tract is negligible. Since blood contains minute quantities of calcium, precautions were taken to avoid loss of blood during the dissection.

The actual weights of the carcasses were carefully taken and used as the basis of all calculations. The group weights were taken, then the carcasses were placed in suitable glass containers, covered with three per cent acetic acid, and processed in the autoclave for a period of 4 hours at 15 pounds steam pressure. This process rendered the fur, bones, teeth, and flesh soft, so that they were easily homogenized in the Waring Blendor. The homogenized mixtures were weighed and samples were taken for calcium analysis. The method used by the Association of Official Agicultural Chemists (1945) for calcium analysis was followed. To determine the exact calcium intake of each, the experimental diets were analyzed for their calcium contents. Results of analysis are found in Table 5. The composition of the experimental diets and their calcium contents are shown in Table 2.

RESULTS AND DISCUSSION

Rats fed with canned bañgos, dried alamang, and balut diets showed normal gain in weight and appeared to be in good health throughout the assay period. Table 4 shows that the rats fed with the canned bañgos ration had a remarkable gain in weight until the end of the assay period as compared to the other groups. The control rats and those fed with bagoong alamang diet were apparently in poor health, and exhibited only a slow gain in weight which could be attributed to loss of appetite. These rats were physically inactive and slow to respond to external influences during the course of the assay period. Rats fed with the oyster shell ration showed slow gain in weight at the start of the assay period but indicated a substantial gain at the end of the experiment.

TABLE 3.—*Growth and food consumption of rats on the various diets.*

Number of rats	Supplement	Average food intake[a]	Weight		
			Initial	Final	Gain
		gm.	*gm.*	*gm.*	*gm.*
10	None	161.9	49.7	88.0	39.3
10	Bagoong alamang	178.2	49.9	96.3	46.4
10	Dried alamang	174.0	50.1	108.0	47.9
10	Canned bañgos	195.3	50.8	111.8	61.0
10	Oyster shell	180.6	49.7	104.1	54.4
10	Balut	182.9	49.7	102.3	52.6

[a] Average food intake for the total experimental period.

To determine the significance of calcium on the rate of growth a comparison of the average weekly weights of the rats was made (fig. 1). Rats fed with the canned bañgos diet showed the greatest gain in weight at the end of the experimental period. Following in their order were those fed with dried alamang, balut, oyster shell, and bagoong alamang. As shown in Table 3 rats fed with canned bañgos diets had the greatest food intake. It was also observed that the rats fed with bagoong alamang and oyster shell diets together with the control rats showed general body weakness coupled with lessened activity and susceptibility to hemorrhages.

TABLE 4.—*Average weekly weights in grams of rats fed with different experimental diets.*

Group number	Initial weight in gms.	Number of weeks			
		1st week	2d week	3d week	4th week
I (Control)	49.7	63.2	74.8	84.1	88.0
II (Bagoong alamang)	49.9	63.2	72.0	86.2	96.3
III (Dried alamang)	50.1	69.2	84.5	96.3	108.0
IV (Canned bañgos)	50.8	70.3	87.9	97.4	111.0
V (Oyster shell)	49.7	66.5	77.6	89.2	102.0
VI (Balut)	49.7	72.3	89.3	101.7	102.3

It is evident from Table 5 that the rats given the canned bañgos diets exhibited the greatest percentage of calcium retention. The calcium of dried alamang and balut used in this experiment was utilized almost to the same degree as that of balut. The rats fed with the bagoong alamang diet stored the least amount of calcium. It is interesting to note that dried alamang contains a greater percentage of available calcium than bagoong alamang in spite of the fact that they are both prepared from the same species of crustacean, differing only in their methods of preparation.

TABLE 5.—*The retention of calcium by the rats.*[a]

Calcium supplement	Total calcium consumed	Calcium supplied by supplement	Total calcium in rats	Additional calcium retained by supplemented animal	Supplementary calcium retained
	mgm.	*mgm.*	*mgm.*	*mgm.*	*Per cent*
Bagoong alamang	317.0	249.0	569.0	117.0	47.0
Dried alamang	363.0	295.0	691.0	239.0	81.0
Canned bañgos	597.0	529.0	896.0	444.0	83.90
Oyster shell	266.0	198.0	584.0	132.0	66.7
Balut	157.0	89.0	524.0	72.0	80.9
Control	68.0	----------	452.0	----------	----------

[a] Figures in the table represent the average of the result.

The low percentage of calcium retention in bagoong alamang diet may be due to the presence of big amounts of salt and possibly the formation of insoluble calcium compounds as a result of the combination of calcium with fermentation products. No conclusion, however, could be deduced from this assumption. Retention of calcium in oyster shell diet was evidently better than that of the bagoong alamang. The average percentages of calcium retention for canned bangos, dried alamang, balut, bagoong alamang, and oyster shell are 83.9, 81.0, 80.9, 66.7, and 47.0, respectively.

SUMMARY AND CONCLUSIONS

Six groups with ten rats each were fed experimental diets containing calcium in the form of bagoong alamang, dried alamang, canned bangos, oyster shell, and balut. The sixth constituted the control group. Water and food were given *ad libitum*. Regular weekly weights were taken and observations were made daily on the health and physical behavior of the experimental animals. At the end of the assay period the animals were killed with chloroform, dissected to remove the stomach and intestine, processed wholly in the autoclave, homogenized, and samples examined for calcium analysis.

The following conclusions are made from the results of the experiment:

1. Percentage retention of calcium for the different products tested are the following: canned bangos, 83.9; dried alamang, 81.0; balut, 80.9; oyster shell, 66.7; and bagoong alamang, 47.0.
2. Canned bangos or dried alamang can be considered good dietary supplements for milk as a source of calcium.
3. Bagoong alamang is the poorest dietary source of calcium when fed under the conditions of this experiment, although it may serve as a good source of protein and phosphorus in the Filipino diet.
4. Considering the percentage of calcium retention in oyster shell, this product has excellent possibilities as a supplement for poultry feed.

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ILLUSTRATION

TEXT FIGURE

FIG. 1. Growth curve of rats fed with the different experimental diets.

POSTLARVAL FORMS OF MARINE FISHES OF SIOKUN BAY, ZAMBOANGA DEL SUR PROVINCE

By GUILLERMO J. BLANCO
Of the Bureau of Fisheries, Manila

NINETEEN TEXT FIGURES

Upon the termination of the United States Fish and Wildlife Service, Philippine Fishery Program in 1950, the bulk of the fishery collections was turned over to the Philippine Bureau of Fisheries. Some of the juvenile and postlarval marine fishes included in the plankton tows and night-light fishing collections were not worked out, except the young of tunas, which had been extensively studied.

This paper presents a systematic study of young fishes which were collected by the biological staff of the research vessel *Spencer F. Baird* at Siokun Bay, Zamboanga del Sur, on November 19, 1948.

The families of fishes represented in the Siokun Bay collection are Elopidæ, Ophichthyidæ, Synodontidæ, Syngnathidæ, Atherinidæ, Mugilidæ, Theraponidæ, Ambassidæ, Serranidæ, Lutjanidæ, Mullidæ, Sillaginidæ, Platycephalidæ, Pomacentridæ, and Monacanthidæ.

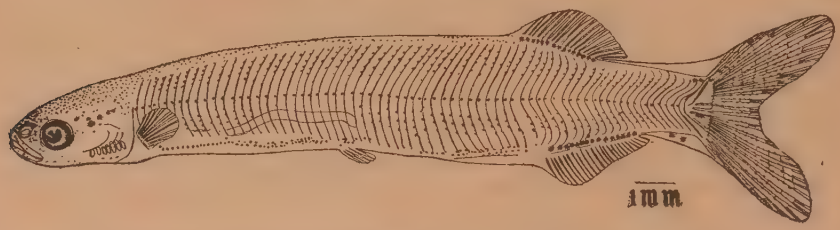
The species of marine postlarval fishes described under the above families are as follows: *Megalops cyprinoides, Ophichthys* sp., *Saurida tumbil, Ichthyocampus* sp., *Atherina* sp., *Mugil* sp., *Ambassis* sp., *Therapon theraps, Epinephelus morrhua, Lutianus monostigma, Sillago sihama, Pseudupeneus* sp., *Platycephalus* sp., *Pomacentrus philippinus, Monacanthus* sp., and *Cantherines* sp.

ELOPIDÆ

MEGALOPS CYPRINOIDES (Broussonet). Tarpon (buan-buan). Text fig. 1.

Description.—The larval tarpon passes through a "leptocephalus" stage similar to those of the ten pounder. A larva 13.5 millimeters long, elongate, transparent, narrow and compressed in body with about 68 myotomes. Depth of body, 5.5 in standard length; head small and undeveloped, 5.5 in length; snout dull pointed, equal to eye ball diameter in length,

4.20 in length of head; eyes midlateral, 3.33 in head; mouth oblique; angle of maxillary beneath anterior edge of diameter of eye. Branchiostegals three. Dorsal fin with traces of 18 soft rays, at posterior third of body, near caudal fin. Anal fin of 24 rays near caudal fin. Anterior portion of anal fin lobe starts ventrally below opposite two-thirds of base length of dorsal fin, and very much nearer to caudal fin than dorsal fin. Pelvic fin small and ventrally located at midportion of body.



TEXT FIG. 1.—*Megalope cyprinoides.* From a specimen 13.5 mm. long.

Homocercal caudal fin large with a deep notch with 22 caudal rays, attached to upturned urostyle, epurals and hypurals. Caudal peduncle with remnants of dorsal and ventral finfold as long as broad. There are a few stellate pigments on upper part of opercle, at bases of soft fin rays of dorsal and anal fin and at posterior portion of caudal peduncle. On head, maxillaries, all over sides of body and on caudal rays are numerous small dark pigments. At midlateral section of body is a single longitudinal row of rounded dots of pigments. Ventral side of the body between lower portion of pectoral and pelvic fins and anterior ventral fin are located rounded pigments.

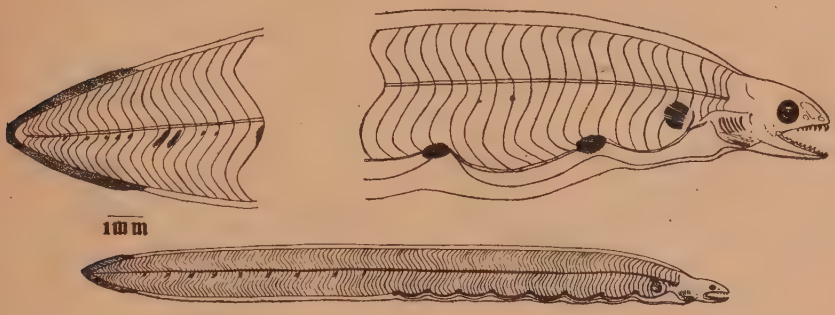
A single specimen 13.5 millimeters long is described from the Siokun Bay, Zamboanga del Sur, larval fish collection, November 19, 1948.

OPHICHTHYIDÆ

OPHICHTHYS sp. Eel (palos, pindanga, igat). Text fig. 2

Description.—A leptocephalus stage, 150 millimeters long, ribbonlike, elongate, transparent and thinly compressed in body. There are about 146 or more myotomes, 70 of which are located to last pigment oblong spot of ventral eighth constriction of gut. Head very primitive, mouth horizontal; angle of maxillary

on level of perpendicular edge of eye; opercle and preopercle not very distinct except for traces of six gills slits above traces of branchiostegals. Entire finfold distinct which loops around arrow-pointed leptocercal caudal fin which is a characteristic of adult species.



TEXT FIG. 2.—*Ophichthys* sp. From a specimen 150 mm. long.

There is a trace of a long lateral line originating above the gill slits bisecting the curve contours of the myomeres to the tip of the leptocercal caudal fin. Below the posterior portion of the lateral line are eight dark pigment spots.

Under this genus are found thirteen species of marine eels.

Specimens of leptocephalus stages of eels were few in the Siokun Bay, Zamboanga del Sur collection of November 19, 1948.

SYNODONTIDÆ

SAURIDA TUMBIL (Bloch). Lizard fish (kalaso). Text fig. 3.

Description.—The postlarval lizard fish, 25 millimeters long, has a very elongate, narrow and cylindrical body. Forty-nine myotomes and forty-six rectangular chromatophores located on midlateral sides of body, behind curves of each myomere. Fish easily recognized by its short blunt head, large inferior snout, large eyes, and serrated preopercle. There are three chromatophores on lateral side of head above opercle, a black area below pectoral fin, a chromatophore located before first dorsal spine, small chromatophores after base from third to eighth sharp dorsal spines and three elongate chromatophores between sharp dorsal and adipose fin. Three equidistant longitudinal narrow chromatophores ventrally located between posterior portion of long fan-like pelvic fin and narrow and

short ventral fin, besides five chromatophores at posterior bases of tenth to fourteenth spinous ventral fin. Dots of black chromatophores or areas spread on posterior portion of caudal peduncle extending into anterior portion of caudal fin. Head 4⅘ in standard length of body. Snout pointed, 7.5 in length of head. Eyes large; eye diameter 3 times in length of head; snout slightly oblique or horizontal; maxillary reaches beyond posterior eye diameter; vomerine teeth in upper and lower jaws. Dorsal X; ventral fin 6; anal 14; caudal rays 20.

TEXT FIG. 3.—*Saurida tumbil.* From a specimen 25 mm. long.

Last spine of first dorsal fin halfway between dorsal tip of snout and posterior portion of caudal peduncle. Adipose fin small and opposite anal fin. Caudal peduncle twice as long as narrow; caudal fin homocercal.

Color in alcohol creamy yellow with black spots of chromatophores on head, dorsal, lateral and ventral sides of the body.

The lizard fishes are a group of common shore fishes staying close to the sandy or muddy bottom or else found in deeper waters. Seven species have been recorded in the Philippines. The most abundant are the common lizard and the blunt nosed which are caught with the beam trawl in Manila Bay and elsewhere in the Philippines.

Several specimens, 25 millimeters and over, were collected at Siokun Bay in November 19, 1948.

SYNGNATHIDÆ

ICHTHYOCAMPUS sp. Pipe fish (quioet). Text fig. 4.

Description.—One young pipe fish 59.5 millimeters long, cylindrical and slender in body form with crossbars of black bands of dots and a long whiplike tail. Head long, and slender; snout tubular, terminating into a small mouth with toothless jaws. Dorsal fin with traces of soft rays, located about midway between tip of mouth and posterior edge of caudal peduncle. Pectoral not conspicuous. Caudal fin fanlike with 9 spinous unequal rays.

This specimen, 59.5 millimeters long, was included in the collection of Siokun Bay, Zamboanga, on November 19, 1948.

TEXT FIG. 4.—*Ichthyocampus* sp. From a specimen 59.5 mm. long.

ATHERINIDÆ

ATHERINA sp. Silverside (ti-i). Text fig. 5.

Description.—A larval silverside, 7 millimeters long, elongate, compressed and transparent in body. Head with an oblique mouth, is short; head 4 times in length of body. Body myotomes are distinct and scales wanting. Midlateral portion of body with series of black pigments or chromatophores starting from underneath of base of pectoral fin to base of caudal. First dorsal fin with five weak spines located at mid-portion of dorsal portion of body. Anterior base of dorsal fin equidistant from tip of snout with reference to dorsal base of caudal fin. First anterior spine of anal fin nonopposite base of anterior spine of dorsal fin. Narrow caudal peduncle as long as upper lobe of deeply forked caudal fin.

Several specimens were collected at Siokun Bay, Zamboanga del Sur Province, on November 19, 1948.

TEXT FIG. 5.—*Atherina* sp. From a specimen 7 mm. long.

MUGILIDÆ

MUGIL sp. Mullet (banak, liza, talilong, lapez, risec). Text fig. 6.

Description.—The postlarval mullet, 7.8 millimeters long, has an elongate, cylindrical, and slightly compressed body. Depth of body 3.5 in standard length. Head convex, slightly flattened dorsally; eye diameter 3 times in head length. Mouth oblique; length of snout, less than diameter of eye; angle of maxillary, not reaching edge of anterior level of eye. Dorsals

V, 1–7; first dorsal spine of first dorsal, equidistant from level of edge of snout spiracle to posterior edge of caudal peduncle. Anal II, 8. Caudal peduncle as long as broad. Caudal rays 20. Anus protrudes before first short anal spine.

TEXT FIG. 6.—*Mugil* sp. From a specimen 7.8 mm. long.

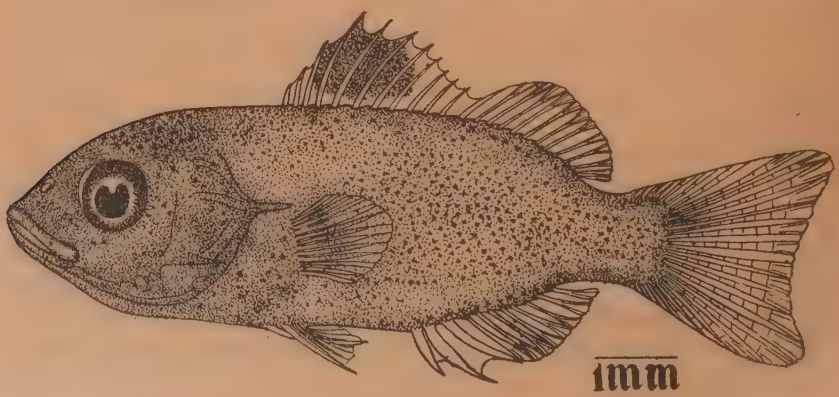
This specimen is naked and with stellate chromatophores on the snout, head, preopercle, dorsolateral, lateral and ventral sides of the body. The chromatophores are grouped at the abdominal and lateral region of the body. The background of these stellate chromatophores on the head and all over the sides of the body are minute dark pigments.

Specimens of larval mullets were not abundant from the collection from Siokun Bay, Zamboanga, November 19, 1948.

THERAPONIDÆ

THERAPON THERAPS Cuvier and Valenciennes. Theraponid (bagaong, baraongan). Text figs. 7–8.

Description.—A young theraponid, 8 milimeters long, semi-oblong in shape and compressed in body; lateral line wanting (text fig. 7). Depth of body 3 times in standard length; head,



TEXT FIG. 7.—*Therapon theraps*. From a specimen 8 mm. long.

2.66 in standard length; eye diameter 3.33 in head length; snout 3.25 in head length or shorter in eye diameter; mouth small, oblique; posterior edge of maxillary reaching anterior level of eye. The upper edge of opercle with pointed spine above the gill opening; preopercle with serrations. Caudal peduncle as long as broad. Dorsals continuous and notched; XI–1, 11, anal III, 8; pectoral with 12 rays, rounded in outline. Caudal fin of 20 rays, shallow notched. Stellate and minute pigments of black chromatophores on the head, bases of the dorsal anal fins, all over the sides of the body, and membranes of the spinous dorsal.

A 12.5 millimeters postlarval, three line, theraponid oblong and compressed in body (text fig. 8). Depth of body 2.5 in

TEXT FIG. 8.—*Therapon theraps.* From a specimen 12.5 mm. long.

standard length. Head large, 2.5 in standard length; eye diameter 3 times in head; length of snout, shorter than eye diameter. Mouth oblique; posterior angle of maxillary on level with anterior level of edge of eye socket. Pointed gill opening spine still retained at this stage. Minute serrations present below the eye. Preopercle spines unequal, small and distinct. Branchiostegals 5. Dorsals continuous, notched XI–1, 10; and III, 10. Caudal peduncle, as long as broad. Caudal fin with 20 rays. Black stellate, chromatophores on the membranes of spinous dorsals, soft rays of dorsal and anal fins. Three narrow elongate black pigments on the anterior half of caudal rays. Eight groups of black spots on the upper sides of the

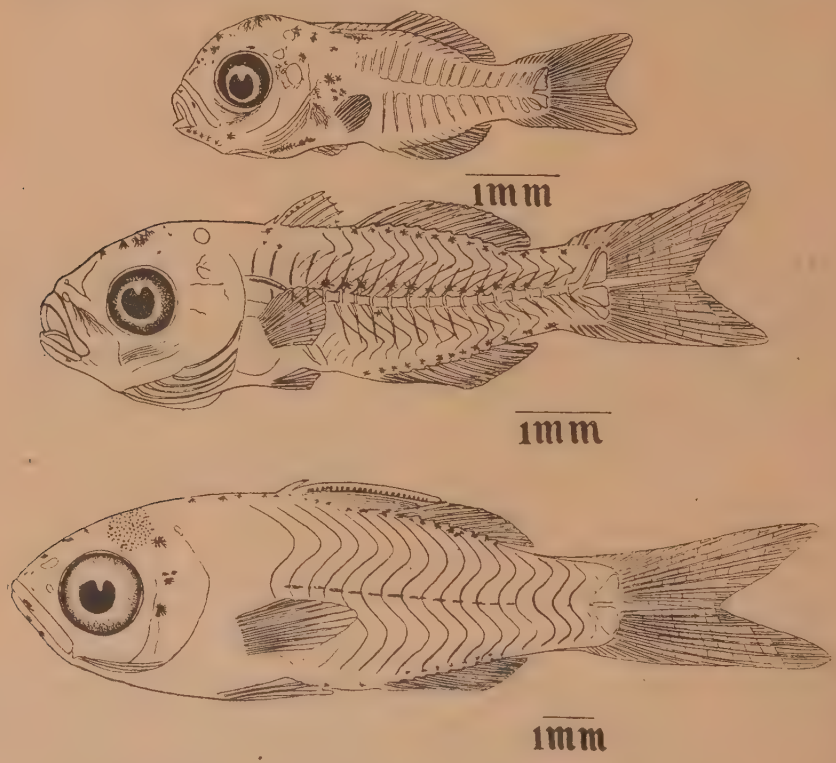
head and body. Small and stellate pigments of chromatophores all over the sides of the body.

Numerous specimens of theraponids were in the Siokun Bay collection, Zamboanga del Sur, on November 19, 1948.

AMBASSIDÆ

AMBASSIS sp. Glassperch (langaray, bagsang). Text figs. 9–11.

Description.—A larva, 4 millimeters long, stocky, compressed and transparent in body (fig. 9). Body depth 3 times in length. Traces of the vertebral column spines apparent. Head large,



TEXT FIGS. 9–11.—*Ambassis* sp. From a specimen 4–12 mm. long.

2.66 standard length; eye diameter 2.5 in head. Mouth small and oblique; length of snout equal in diameter of eye ball. Opercle with 4 branchiostegals. Dorsals and ventrals not well developed. Pectoral small. Caudal peduncle, 11.5 times as long as broad. Homoceral caudal fin deeply notched. Large and small stellate chromatophores pigments on the head, chin,

between the opercle and pectoral fin and below the opercle. The fish larva, 5.66 millimeters long, elongate, compressed, transparent in body with traces of myotomes, 20 vertebrae, vertebral spines, urostyle and epurals and hypurals (fig. 10). Depth of body 3.5 in standard length. Head, 3.8 in length; eye diameter, 2.75 in head. Mouth oblique and maxillary not reaching below level edge of eye diameter. Snout as long as diameter of eye ball. Opercle with 5 branchiostegals at lower edge corner. Dorsals VI, I, 9; anal II, 10. Caudal peduncle 1.25 as broad. Caudal rays 18 on epural and hypural. Scanty chromatophores on top of head but with stellate pigment spots at the bases of the dorsal and anal fin rays on the midlateral sides of the body and on the second spinous rays of first dorsals.

A 12-millimeter larva with an elongate and compressed body with distinct myotomes; depth 3 in standard length (fig. 11). Head large, 3 times in length; mouth oblique; snout 2 times in diameter of eye which is 2 times in head length; angle of maxillary beyond anterior, perpendicular level of edge of eye. Opercular edge rounded with traces of 4 branchiostegals on lower edge. Dorsals VI, I, 9; anal II, 10. Caudal penduncle 1⅓ times as long as broad. Homoceral tail with 18 rays. Scanty chromatophores on the head, chin, opercle on the bases of the dorsal and anal fins. Rounded small dot pigments on the inner border of the second dull-pointed spine of first dorsal. Narrow pigments on the midlateral sides of the body.

Several specimens 4–12 millimeters long were collected at Siokun Bay, Zamboanga, on November 19, 1948.

SERRANIDÆ

EPINEPHELUS MORRHUA (Cuvier and Valenciennes). Sea bass (garopa). Text fig. 12.

TEXT FIG. 12.—*Epinephelus morrhua.* From a specimen 8 mm. long.

Description.—A postlarval garopa 9.35 millimeters long, elongate and compressed in body; depth 3.5 in standard length.

Head short and convex, 3 in length; mouth small, oblique and the angle of maxillary not reaching parallel edge of anterior eye socket. Snout small, convex, 1.75 in eye diameter. Dorsals continuous XI, 15; anal II, 10; caudal (with broken tips) truncate, of 24 rays. Traces of fine unequal lengths and breadth of parallel bands of brown to olive chromatophores present on sides of the body.

Postlarval sea bass were found numerous in the Siokun Bay, Zamboanga del Sur collection of November 19, 1948.

LUTIANIDÆ

LUTIANUS MONOSTIGMA (Cuvier). Snapper (maya-maya). Text fig. 13.

Description.—Young maya-maya, 14.5 millimeters long with a leaflike and slightly compressed body, and with a triangular head with reference to the posterior edge of the opercle as a base; 2.5 in standard length; mouth oblique; maxillary reaching beyond anterior level of eye margin. Eye diameter as long as snout; 3 times in head length. Preopercle with minute serrations diagonally with larger spines located ventrally. Branchiostegals 5.

TEXT FIG. 13.—*Lutianus monostigma*. From a specimen 14.5 mm. long

A curved lateral line starts at the upper corner of edge of opercle bisecting the ocellus on the upper midpoint of the body. Caudal peduncle as long as wide. Dorsals continuous X–10, first predorsal spine sharp, and short followed by nine longer

pointed spines and ten soft rays the last of which is branched; central portion membranes of first dorsal with dark chromatophore spots. Anal III, 8; first stocky sharp spines unequal, the middle being the longest. Pelvic fins with two long sharp spines. Pectorals leaf-like and rounded at the edge. Caudal slightly notched and with 20 rays.

This postlarval maya-maya is devoid of scales. Dark pigment spots are on the snout, head, body and ventral portions of the dorsal and anal fins. The most prominent group of chromatophores is the ocellus which identifies this species as the one-spotted gray snapper in the adult.

Pelagic specimens of juvenile snappers measuring from 11 to 27 millimeters were collected on November 19, 1948, at Siokun Bay, Zamboanga Province.

SILLAGINIDÆ

SILLAGO SIHAMA (Forskal). Sandborer (Asohos, asoos). Text fig. 14.

Description.—A postlarval asohos, 14.5 millimeters long with elongate and rounded body. Depth of body 5.2 times in standard length. Head, 3.25 in length. Snout shorter than eye diameter; mouth oblique; anterior angle of maxillary extends beyond anterior level of eye socket. Branchiostegals 5. Dorsal fins separate. Dorsals XI—1, 18; anal II, 18. Dermotrichia

TEXT FIG. 14.—*Sillago sihama.* From a specimen 14.5 mm. long.

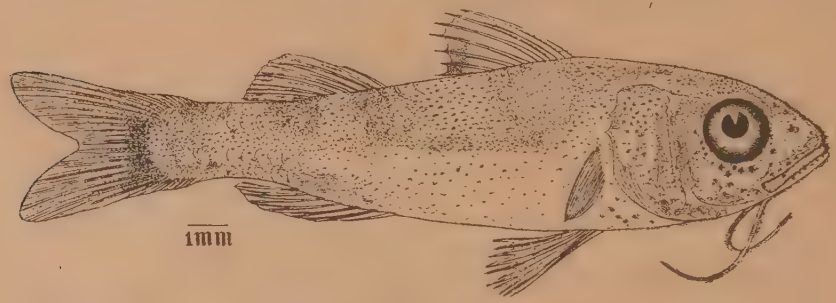
attached by hypurals and epural, 18. Caudal peduncle 1.33 as long as broad. Caudal fin shallow forked. Lateral line present. Scales present; four groups of narrow blotches on the mid-posterior half of the body. Black stellate pigments at bases of fin rays, a few of these chromatophores on the head. The tip of pectoral rounded, reaching half way of the level of base length of first dorsal fin.

A few of the asohos postlarval fishes are in the collection of Siokun Bay, Zamboanga del Sur, on November 19, 1948.

MULLIDÆ

PSEUDUPENEUS sp. Goatfish (saramullete). Text fig. 15.

Description.—A specimen 16.75 millimeters long, with an elongate and slightly compressed body with traces of a few ctenoid scales at the anterior portion of the caudal peduncle and on the pre-dorsal spines at the second dorsals. Head slightly convex, 4⅘ in standard length. Snout triangular, 3.5 in head length. Mouth oblique; maxillary of upper jaw on level with edge of anterior of eye diameter. Preopercle with a few distinct spines at the lower and upper extremities. Opercle with two distinct spines at the upper edge. Branchiostegals 6. Two protruding barbels beneath the chin below the maxillary. Body depth 4⅘ in standard length. Dorsals VI—1, 7.



TEXT FIG. 15.—*Pseudupeneus* sp. From a specimen 16.75 mm. long.

Anal I, 6. Homocercal caudal fin with 16 rays. Five black blotches on the upper portion of the body with dark pigment spots in between the spots at the end of caudal rays. Dark pigment spots also spread sparsely at the abdominal region. Distinct stellate chromatophores on the lower and upper jaws beneath the eye and on the upper corner of the opercle. Dark pigments also on the upper membrane of the dorsal fin.

About twenty-five species of goatfishes have been recorded in the Philippines.

There are twenty specimens measuring from 10.5 to 27 millimeters long, collected at Siokun Bay, Zamboanga del Sur, on November 19, 1948.

PLATYCEPHALIDÆ

PLATYCEPHALUS sp. Flathead (sunog). Text fig. 16.

Description.—A flathead, 6.5 millimeters long with a cylindrical body which tapers posteriorly. Body depth 3.33 times

in standard length. Head large, flattened and triangular, 2 times in length. Snout 3 times in head. Mouth slightly oblique in position; angle of maxillary reaching below level midportion of eye. Opercle armed with three sharp spines at the upper corner. Branchiostegals 5. Dorsals VIII—9; anal III, 7. Pectoral with 16 rays large, and located midway between tip of snout and posterior edge of caudal peduncle. Pelvic fins long tips reaching first anal spine origin and parallel with origin of pectoral. Caudal peduncle three times as long as broad. Caudal fin with 16 rays slightly truncate or rounded. The larval fish is brownish to black in color, with rounded black spots on sides of body.

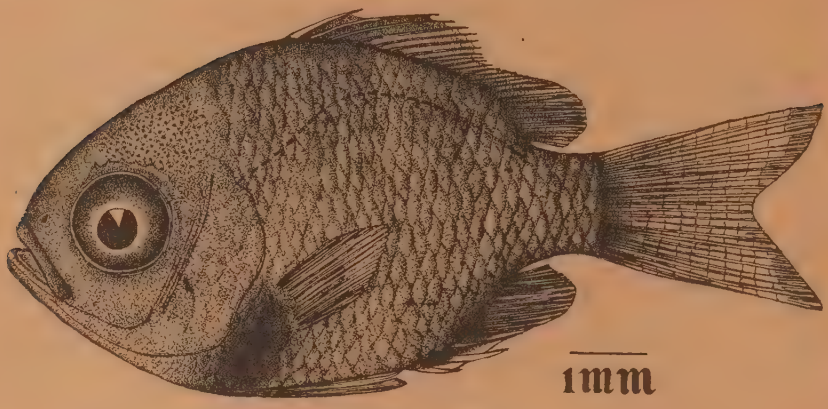
TEXT FIG. 16.—*Platycephalus* sp. From a specimen 6.5 mm. long.

The only specimen 6.5 millimeters long was collected at Siokun Bay, Zamboanga on November 19, 1948.

POMACENTRIDÆ

POMACENTRUS PHILIPPINUS Everman and Seal. Damsel fish (araro baybay, puyong dagat, tibuk). Text fig. 17.

Description.—A postlarval damsel fish, 7.75 millimeters long with an ovate body with dorsal and ventral outline similar and evenly arched; body depth 1.75 in length. Head triangular in outline, 2.23 times in length. Caudal peduncle short, twice as long. Snout short, 1.5 in eye diameter, 2.5 in length of head; mouth oblique; maxillary 2.5 ending posteriorly below anterior margin of eye; each jaw with a series of small teeth. Sub-orbital coarsely serrated. Opercle scaled; preopercle with minute serrations. Dorsals XIII, 13, continuous and notched. Spinous dorsal increasing in height. Anals II, 13. Outline of posterior and dorsal fins rounded.



TEXT FIG. 17.—*Pomacentrus philippinus*. From a specimen 7.75 mm. long.

Scales on lateral series 26; lateral line ending before posterior end of soft dorsal. Caudal fin deeply forked, with 24 caudal rays.

Postlarval damsel fishes are abundant in the Siokun Bay, collections of November 19, 1948.

MONACANTHIDÆ

MONOCANTHUS sp. File fish (papakol). Text fig. 18.

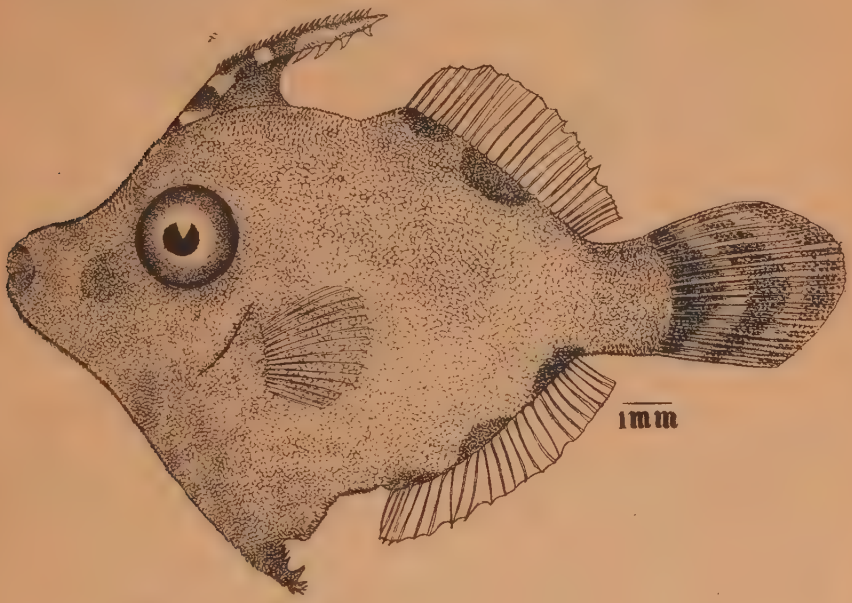
Description.—A young file fish, 13 millimeters long with oblong, compressed body; greatest depth, 1.5 in standard length. Head short, concave dorsally; small and terminal lip thick with blunt minute teeth. Eyes, dorsolateral, diameter shorter than snout. One gill slit anterior of small pectoral fin. Opercles wanting. Dorsals I, I, 25. First dorsal curved posteriorly, stocky with numerous small spines on posterior ⅔ of its length and also four larger curved down spines above thin basal triangular membrane. Second dorsal with one fine spine followed by 25 fin rays. Anal I, 24, similar in contour to that of dorsal fins. The pelvic spine has inner spines, two of which are very prominent, followed by a series of finger-like spines.

Pectoral fin rays 15. Edge of outer arch not reaching perpendicular level of anal spine. Caudal peduncle shorter than broad. Caudal fin fanlike, with a rounded edge. Caudal rays 16.

Head and body are covered with minute velvety shagreen scale with interlacing bases. There are four prominent dark areas of black spots on the stocky, cylindrical sharp spine of first dorsal the basal membrane of which is dark pigmented. On

the dorsal side of the body below the base of the second dorsal are also two groups of dark pigments. On the ventral side of the body are also three dark pigment areas above the base of the anal fin. The caudal fin has three arch contours of pigment spots.

One specimen, 13 millimeters long, was collected at Siokun Bay, Zamboanga del Sur, on November 19, 1948.



TEXT FIG. 18.—*Monacanthus* sp. From a specimen 13 mm. long

CANTHERINES sp. File fish (papakol). Text fig. 19.

Description.—The larval file fish 3.5 millimeters long with oblong, transparent and compressed body. Body depth 1.5 in standard length; head large, triangular in shape; mouth small with thick lips, length of snout equal eye diameter, eyes big dorsal-lateral. Dorsals I, 22. Anal I, 19. Origin of first dorsal opposite that of big branched or fingerlike anal spine. Contour outline of dorsal and anal fins similar. Pectoral with 15 rays located at midlateral side of body. Caudal peduncle shorter than broad and caudal fin lobe, fanlike with 12 caudal rays.

There are two groups of black irregular spots on the head above the eye and below the first dorsal. Ventrally there are also three dark areas of irregular spots located on the anal spine and at the extreme bases of the anal fin. Caudal peduncle

TEXT FIG. 19.—*Cantherines* sp. From a specimen 3.5 mm. long.

is pigmented also with similar irregular dark spots. The larva is light yellow to orange in color.

One specimen 3.5 millimeters long was included in the Siokun Bay, Zamboanga del Sur collection of November 19, 1948.

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ILLUSTRATIONS

[Drawn by G. J. Blanco]

TEXT FIGURES

FIG. 1. *Megalops cyprinoides.* From a specimen 13.5 mm. long.
2. *Ophichthys* sp. From a specimen 150 mm. long.
3. *Saurida tumbil.* From a specimen 25 mm. long.
4. *Ichthyocampus* sp. From a specimen 59.5 mm. long.
5. *Atherina* sp. From a specimen 7 mm. long.
6. *Mugil.* sp. From a specimen 7.8 mm. long.
FIGS. 7–8. *Therapon theraps.* From specimens 8–12.5 mm. long.
9–11. *Ambassis* sp. From specimens 4–12 mm. long.
FIG. 12. *Epinephelus morrhua.* From a specimen 8 mm. long.
13. *Lutjanus monostigma.* From a specimen 14.5 mm. long.
14. *Sillago sihama.* From a specimen 14.5 mm. long.
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16. *Platycephalus* sp. From a specimen 6.5 mm. long.
17. *Pomacentrus philippinus.* From a specimen 7.75 mm. long.
18. *Monacanthus* sp. From a specimen 13 mm. long.
19. *Cantherines* sp. From a specimen 3.5 mm. long.

COMMERCIAL TRAWLING IN THE PHILIPPINES [1]

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ELEVEN PLATES AND TWENTY-FOUR TEXT FIGURES

INTRODUCTION

During the last three decades a trawl fishery of some magnitude was developed in the Philippines. This development was most significant during the postliberation period when the demand for fresh fish was great and the fishing business as a whole was enjoying an unprecedented boom. During the same period improvements of the trawl gear and vessel equipment were made. Noteworthy among these improvements was the successful introduction and commercial adoption of the stern-set otter trawl from the Gulf and West Coasts of the United States.

TABLE 1.—*Landing in kilograms by commercial trawlers in the Philippines.*

Species	1953	1952	1951	1950	1949
Croakers	1,517,211	1,226,912	963,285	1,658,058	853,981
Crevalle	535,872	241,779	285,525	1,070,811	1,547,841
Cutlass fish	52,764	35,574	39,030	64,584	480,364
Grunts	48,993	29,589	28,676	38,322	109,748
Lizard fish	2,694,312	2,147,407	2,440,764	1,869,696	1,280,972
Mojarras	3,000				266,869
Nemipterid	2,022,768	1,456,836	1,872,311	2,676,009	1,868,080
Shrimps	1,618,371	1,311,375	1,149,830	1,092,996	1,334,346
Squids	22,758	16,143	19,092	11,674	376,746
Slipmouths	12,871,131	11,148,732	10,426,006	8,804,000	4,480,364
Miscellaneous	366,582	326,253	315,574	242,790	2,634,462
Total	21,753,762	17,840,590	17,540,093	17,528,844	15,233,773

Species	1948	1947	1946	1940
Croakers	328,939	354,777	758,667	189,902
Crevalle	1,053,039		448,191	59,861
Cutlass fish	197,721	369,774		3,460
Grunts	392,209			2,300
Lizards fish	1,373,043	809,844	564,507	1,211,224
Mojarras	606,030	1,102,854	286,636	15,197
Nemipterid	1,166,322	1,231,287	461,805	1,805,156
Shrimps	996,015	1,913,907	231,055	785,818
Squids	337,713	307,668		
Slipmouths	4,988,865	3,232,497	1,794,867	2,844,191
Miscellaneous	235,590	69,828	298,707	159,137
Total	12,269,546	9,992,436	4,894,335	7,076,246

[1] Portions of this paper were submitted during the Indo-Pacific Fisheries Conference held in Madras, India, on February 16–28, 1951.

Today the trawl fishery is considered among the few ranking sea industries in the Islands with an overall investment of about ten million pesos. In 1953 the catch of the trawling fleet amounted to about 21,753,762 million kilograms valued at no less than 20 million pesos (Table 1). This formed about 43 per cent of all fish landed by commercial fishing vessels of more than three tons gross during the year. About a million pesos of operating capital was utilized to run this industry.

Since 1946 the trawling fleet has continued to increase in number and tonnage reaching a peak of 290 trawling units in 1952. Of this number 234 were reported to be using otter trawls and the rest the Japanese beam trawls (Table 2). However, in 1953 the entire trawling fleet has adopted the otter trawl gear and not a single Japanese beam trawl was used in the commercial fishery.

TABLE 2.—*Registered trawling vessels in the Philippines by fishing areas* [a] *(1946–1953)*

Area of operation	Number of otter-trawl boats							
	1946	1947	1948	1949	1950	1951	1952	1953
Manila Bay	1	3	14	19	48	75	64	60
Lingayen Gulf	------	------	1	3	10	8	12	9
Ragay Gulf	------	------	1	10	3	2	5	--
Tabaco Bay	------	------	------	1	1	------	------	21
Southwestern Samar	------	1	2	2	12	15	13	59
Western Visayan Sea	------	------	1	1	2	32	52	67
Guimaras Strait	------	1	8	19	43	33	58	--
Panguil Bay	------	------	1	1	4	------	------	11
Pilar Bay	------	------	------	------	2	5	8	21
Tayabas Bay	------	------	------	1	3	10	15	17
San Miguel Bay	------	------	------	------	1	3	7	78
Total	1	5	28	57	129	190	234	213

Area of operation	Number of beam-trawl (utase) boats								
	1941	1946	1947	1948	1949	1950	1951	1952	1953
Manila Bay	71	82	97	51	91	84	56	35	------
Lingayen Gulf	15	------	4	2	1	2	3	2	------
Ragay Gulf	4	------	2	8	1	------	1	------	------
Tabaco Bay	------	------	------	------	------	------	------	------	------
Southwestern Samar	8	2	7	6	4	3	10	------	------
Western Visayan Sea	26	------	------	2	4	2	36	10	------
Guimaras Strait	21	1	7	24	54	61	25	9	------
Panguil Bay	5	------	------	------	------	------	------	------	------
Pilar Bay	------	------	------	1	5	5	------	------	------
Tayabas Bay	------	------	------	1	6	------	------	------	------
San Miguel Bay	------	------	------	------	------	------	------	------	------
Total	130	85	116	95	166	157	131	56	0

[a] Indicate numbers of trawlers operating in the areas at the time of the survey. Medium and large trawlers usually change fishing areas from time to time even during the year, depending upon the season and productivity of the ground. Number of dugout trawlers not included in this table being less than three tons gross.

As an established segment of the fishing industry it employs full time no less than 3,000 persons consisting of boat operators, fish traders, patrons, engineers, fishermen, net makers, net tanners, and other shore helpers. This industry has likewise boosted the ice and cold storage industries as well as the fish-salting and drying industry. The maintenance of a more or less steady supply of relatively cheap, fresh fish in most population centers of the Philippines is one of the salient contributions of this industry to the country's economy.

Because of the increasing economic importance of the trawl industry, which has been apparently expanding beyond the capacity of our limited ground resources, an account of the nature and extent of the fishery as a whole and a study of the gear requirements, its operation and the status of fishery, are here deemed worthy of consideration.

The introduction of the trawl gear.—Trawling was first used in the Philippines by the Japanese fishermen in 1900 with the use of small sailing sampans towing three to four Japanese beam trawl (*utase*) nets. In 1928 these small fishing boats were gradually replaced by diesel-powered boats towing one big utase net (Umali, 1932).

However, otter trawling was undertaken about 1909 when an English steam trawler was brought to this country to explore the commercial possibilities of the local ground fisheries. The catch was not enough to sustain the operation and after nine months of fishing, it was discontinued. In 1940–41 the Philipipne Bureau of Fisheries experimented with otter and Danish trawls using existing utase boats, and during World War II the Japanese used otter and *paranzella* trawls in the Philippines.

After the liberation of the Philippines in 1945, trawling was resumed by the Filipino fishermen with the use of the established Japanese beam trawl. In the early part of 1947, one company under the management of the writer rigged up a stern-set otter trawl on a 72-foot combination vessel. The initial trial operation was undertaken in Manila Bay and after "breaking in" the crew commercial fishing operation was extended to Ragay Gulf and the Visayan Islands, thereby reopening these existing grounds after liberation.

From September, 1947 to July, 1949, otter trawl explorations and demonstrations were conducted jointly by the Philippine Bureau of Fisheries and the United States Rehabilitation

Program throughout the Philippines. Through these activities, the otter trawl became more popularly known and its advantages were recognized so that in 1948 it was finally adopted by the commercial trawl fishery.

COMMERCIAL TRAWLING

TRAWLING GROUNDS

The combined existing trawling grounds of the Philippines—Manila Bay, Lingayen Gulf, off Nasugbu, Ragay Gulf, Tayabas Bay, San Miguel Bay, southwestern Samar, Carigara Bay, Guimaras Strait, Western Visayan Sea, Northern Capiz, and Panguil Bay—have an approximate trawlable area of about 4,783 square miles with an average depth of about 15 fathoms (Table 3). The bottom topography of these grounds is generally smooth, muddy to sandy with some scattered rough shoals. Most of these coastal areas seem to be regularly enriched by terrestrial nutrients brought by washings from the adjacent islands. Actually, the major trawling grounds are located around Luzon and the Visayan Islands, where a fairly wide coastal shelf is available (fig. 1). Recent explorations conducted by the joint auspices of the U. S. Fish and Wildfire Rehabilitation Program and the Philippine Bureau of Fisheries (1947–1949) as reported by Warfel and Manacop (1950) showed some 6,000 square miles of other possible trawling areas within the 40-fathom line. These areas are the West Coast of Bataan Peninsula, Mangarin Bay, Burias Pass, Alabat Sound including Lopez Bay, Lamon Bay, Sibuguey Bay, N. E. Camarines Sound, Sisiran Bay, Tabaco Bay, Samar Sea, Leyte Gulf and north and northeast of Taganak Island (north of Borneo). With the exception of Lopez Bay, Sisiran Bay, and Sibuguey Bay, most of these areas indicated relatively low productivity as compared with the existing trawling areas. Moreover, the nature of the bottom was found generally rocky or filled with sunken debris of the last war to sustain any extensive commercial trawling operations. Even deep-water trawling beyond the 40-fathom line to 100 fathoms showed apparent negative results for any extensive commercial operations. The amount of marketable fish seems to decrease as the depth increases, rendering operation unprofitable for any commercial venture (Warfel and Manacop, 1950).

TABLE 3.—*Showing the nature and extent of commercial trawling grounds in the Philippines (1950)*—Continued

Locality	Approximate position		Approximate area	Depth of water	Kind of bottom	Rate of catch per day	Remarks: Species caught
	Latitude	Longitude	*sq. miles*	*fathoms*		*Kgm.*	
Manila Bay	14°34′N	120°42′E	520	1–30	Green mud; gray sand	150-250	
Bataan coast (West side)	14°35′N	120°39′E		1–20	Green mud		Crabs abundant, 1–4 fathoms. December to April shrimp numerous, 14–20 fathoms. Snappers fairly numerous along Cabcabin and Limay.
Pampanga and Bulacan Bays (North side)	14°42′N	120°45′E		1–5	Green mud		Crabs numerous; Leiognathids (jaco) abundant and young of other commercial groups.
Cavite coast (South side)	14°23′N	120°48′E		5–22	Gray sand mud and reef spots		Nemipterids and goatfishes numerous; shrimps 14–17 fathoms. Species generally bigger than rest of the Bay.
Manila Bay Approaches: North Approach West of Bataan Peninsula	14°40′N	120°20′E	110	15–30	Mud and sand	180–300	Nemipterids and Priacanthids and goatfishes numerous. Good fishing during NE monsoon.
South Approach West of Nasugbu and Limbones Cove	14°10′N	120°35′E	100	10–25	Gray sand and mud		Nemipterids, goatfishes, Lactarids numerous. Leiognathids abundant 10–15 fathoms.
Lingayen Gulf	16°15′N	120°10′E	570	up to 25	Soft mud, ground sand with coral spot 27–54 fms.	200–300	Species caught generally larger than Manila Bay; about ¾ of area suitable for trawling.
Southern part (Pangasinan Province)	16°08′N	120°10′E		1–10 10–18	Soft mud; gray sand		Jellyfishes abundant during NE monsoon. Slipmouths and Theraponids abundant.
Eastern part (La Union Province)	16°20′N	120°20′E		20–25	Mud and sand		Lizard fish, Turbots numerous.
				10–15	Soft mud and sand		Red variety of jellyfish abundant during NE monsoon.
Tayabas Bay	13°30′N	121°38′E	150	10–35	Gray sand and mud with many detached rocks	400–600	Slipmouths, lizard fish abundant. Turbots fairly numerous.
Alabat Sound: Lopez Bay and vicinities	14°00′N	122°00′E	50	10–25	Ditto with scattered rock spots	150–250	Snappers and turbots fairly numerous where native bubos are set.

Locality	Approximate position		Approximate area	Depth of water	Kind of bottom	Rate of catch per day	Remarks: Species caught
	Latitude	Longtitude	*sq. miles*	*fathoms*		*Kqm*	
Western part (NW Pangasinan)	16°20′N	120°04′E		1–25	Rocky and corals, mud		With fairly numerous spots of corals, rocks, not very suitable for trawling.
Ragay Gulf	13°27′N	122°30′E	700	5–30	Mud and corals	200–400	About one-seventh of area suitable for trawling. Central and southern part deep and rocky.
Sisiran Bay	13°55′N	123°40′E	20	5			Species generally larger than Manila Bay. Good fishing during NE monsoon. Slipmouths nemipterids abundant, shrimp and lizard fish numerous.
San Miguel Bay	13°50′N	133°14′E	200	1–15	Soft mud with few coral spots	300–600	Good dragging during NE closed to dragger (June to October) and plenty of jellyfishes.
Sorsogon Bay	12°55′N	123°55′E	50	5	Soft mud and sand		Shrimps, croakers, Pomadasids, catfishes, more abundant than in other dragging grounds.
Samar Sea:							
Southwest Samar	11°50′N	124°42′E	300	up to 30	Soft mud	300–500	Good fishing season NE monsoon. Shrimps, brills, Pomadasids numerous. Preponderance of bigger similar species than Manila Bay.
Carigara Bay	11°28′N	124°30′E	200	up to 30	Soft mud with spots of coral rocks		Good fishing season SW monsoon. Bottom fish fairly numerous but not as productive as SW Samar.
Northeast of Biliran and Maripiri Islands	11°40′N	124°35′E	270	up to 30	Gray mud and fine sand		Larger species but fewer than those taken in SW Samar.
Asid Gulf:							
South of Milagros, Masbate	12°05′N	123°30′E	60	up to 10	Mud with spots of reefs	200–500	Same as in SW Samar but slipmouths predominate.
Northeastern Panay:							
Pilar Bay	11°35′N	123°00′E	140	up to 30	Mud and fine sand	300–600	Same as in SW Samar although slipmouths and turbots are numerous.
Concepcion Bay including Estancia Cove	11°25′N	123°12′E	100	up to 15	Mud		Predominantly bigger slipmouths.
Guimaras Strait:							
Northeast of Guimaras Island	10°50′N	122°50′E	350	up to 15	Mud and fine sand	500–1,000	Slipmouths, shrimps, pomadasids abundant, and as a rule bigger than those of Manila Bay.

Southeast of Guimaras Island	10°15′N	122°45′E	250	up to 10	Mud	----------	Ditto with preponderance of bigger species.
Port Misamis: Panquil Bay	8°05′N	123°45′E	40	up to 6	Mud and sand	----------	Gizzard shads, shrimps, mojarras are numerous.
Sibuguey Bay	7°40′N	122°40′E	400	up to 30	Mud with scattered spots of coral growth	----------	Trawled by the Japanese during the occupation (1942–44). Slipmouths and lizard fish numerous.
Coron Bay: Coron Island (East Side)	11°55′N	120°10′E	20	up to 30	Mud and sand scattered spot of coarse gravel	----------	Slipmouths, Nemipterids,
Imuran Bay: Eastern Palawan	10°40′N	119°20′E	50	12	Mud and sand; scattered spot of coarse gravel.	No data available.	Crevalle, and reef fishes fairly abundant.
Taytay Bay: Northwestern Palawan	11°00′N	119°25′E	45	25	------do------	No data available.	Operated by commercial and exploratory trawlers (1951–1952).
Northern Bohol: Northwest of Bohol	10°13′N	124°33′E	88	15	------do------	No data available.	Operated by commercial and exploratory trawlers (1951–1952).

FIG. 1. Trawling grounds in the Philippines. Heavily shaded areas indicate existing commercial grounds and those lightly shaded are possibly potential trawling grounds.

On the whole the insular and tropical nature of Philippine trawling grounds are limiting factors in either extensive or intensive trawling activity here. As a rule, Philippine waters are not overly rich in fish to withstand any prolonged operation with the use of expensive trawling equipment comparable to those employed in the temperate trawling grounds.

From small to medium combination fishing vessels (5 to 30 tons gross) suited for both pelagic and demersal fishing would be the type adaptable to Philippine fisheries. The coastal and inshore trawl fishery will continue to be the mainstay of the commercial ground fisheries provided it is properly managed and regulated. Plans for offshore trawling in the continental shelf along the Southeast Asian Continent are still under study and consideration by some local fishing boat operators.

Table 4 shows the peak trawling season by areas in the Philippines.

TABLE 4.—*Peak trawling season in the Philippines, by areas.*

Trawling area	Peak season	Prevailing winds
Lingayen Gufl	May to October	SW
Manila Bay	May to December	SW and NE
Northern Capiz in Pilar Bay	May to September	SW
North Guimaras	October to May	NE, E, & SE
Off Nasugbu and Bataan Peninsula	November to May	E and SE
Panguil Bay	May to October	NE, E & SE
Ragay Gulf	October to May	NE, E & SE
San Miguel Bay	May to October	SW
Sibuguey Bay	October to May	NE, E & SE
South Guimaras Strait	May to October	SW
Southwestern Samar, Maqueda Bay and Carigara Bay	October to May	SW
Tayabas Bay	June to December	NE, E & SE
Western Visayan Sea and Asid Gulf (Masbate)	October to May	NE, E & SE

OPERATING CONDITIONS AND FISHING SEASONS

Weather.—The prevailing weather conditions are important factors in any successful fishing operation. Because the Philippines is bounded on its western and eastern coasts by two large bodies of water, especially those along the east coast by Pacific Ocean, the prevailing air currents often cause heavy swells from the northeast and southwest directions making almost impossible the operation of the greater number of small type of trawlers in the Philippines. For this reason practically all fishing operations have been confined in sheltered bays, straits and sounds throughout the Philippines.

Generally speaking the main Philippine air currents[2] may be divided into three groups: (*a*) the northern (loosely called the northeast monsoon), which streams down along the easterly and southeasterly side of the great Asiatic high-pressure area; (*b*) the trade winds, reaching the Islands from a generally easterly direction and coming from the tropical high-pressure areas of the Pacific; and (*c*) equatorial air (loosely called southwest monsoon), pushing its way across the equator from the strong tropical high-pressure areas of the northern hemisphere. The general direction of these winds over the Philippines are as follows: (*a*) From north to east (northern and trade) locally called *amihan* (Tagalog) during the period from October to January; (*b*) from east to southeast (trade wind, or *salatan*) prevailing from February to April; (*c*) for the rest of the period southerly directions, mainly southwest monsoon, locally called *habagat*, with the concurrent influence of typhoon centers. Steady air currents coming from the northwest and west are generally of cyclonic origin and when accompanied by lowering barometric pressure should serve as a warning of an impending typhoon. These Philippine tropical typhoons are latitudinal in character which affect the different regions of the Philippines in varying degrees and frequency, evidently decreasing in intensity from north to south. Major trawling areas of the Philippines located between 10° and 17° N. latitude are subject to the frequent effects of typhoon, especially during the period from September to December. These tropical typhoons are often dangerous, if not destructive, especially to small fishing crafts.

Tides.—Experience has shown that the tidal currents in most trawling grounds are not sufficiently strong to hamper operations of an average-sized trawler. At times, however, near the narrow channels of Corregidor, Guimaras Strait, and southwestern Samar and San Miguel Bay the tidal current runs with moderate force, especially during flood and ebb tides, making dragging quite difficult but not necessarily impossible.

THE FISHERMEN

Before and up to the outbreak of World War II, the beam trawl fleet were manned by from 50 to 70 per cent Japanese fishermen and the vessels were largely owned by organized

[2] Climate of the Philippines. Commonwealth of the Philippines, Dept. of Agriculture and Commerce, Manila, 1939.

Japanese fishing associations. Since liberation in 1945, all the trawlers, both beam and otter, have been completely replaced by Filipino crews and fishermen. This is significant in Philippine commercial fishing since the majority of powered vessels became practically all owned and operated by Filipinos. Even the fishing efficiency of the average Filipino fishermen in the use of the trawling gear has been much improved since liberation.

The postwar manning of powered vessel of more than 5-ton gross has been a problem for boat owner and operators as well. The present-day trawlers are unnecessarily overmanned, compared with prewar and state-side trawlers of equivalent tonnage capacity (Table 5). The number of men in crew of Japanese beam trawlers in the Philippines before the war varied from four to six compared with from eight to twelve men after the war for medium and large trawlers operating in Manila Bay. State-side trawlers are usually manned by about half the number of those of our present trawlers, that is three to five. There are a number of contributing factors affecting the reduction of men in crew on trawling vessels in the Philippines. These are the problems of sorting of the catch which consists of a large number of small-sized species, the lack of trained fishing captains, mates and engineers, requirements of the customs laws and inadequacy of efficient deck machinery for fishing operation. Trained fishing captains as master fishermen at the same time are, however, gradually being filled up by the graduates of the fish-capture course in the Philippine Institute of Fisheries Technology of the Bureau of Fisheries.

The manning requirements and organization of men in crew of Philippine fishing vessels undoubtedly need revision of some of our pertinent customs laws, rules, and regulations through some kind of government legislation. For detailed discussion of manning requirement of Philippine fishing vessels refer to Hinkle (1949).

In the organization of men in the crew of trawling vessels, about a third to half of the crew are not fishermen in the strict sense of the word. Actually, vessel officers attend only to their respective jobs as called for by their vocational training and seldom, if ever, take active part in the actual fishing operation. The regular fishermen, therefore, shoulder the whole burden of the actual fishing operation.

TABLE 5.—*Number of men in crew of Philippine otter trawl vessels compared with state-side manning system.*

Type of vessel	Overall length	Gross tonnage	Deck machinery	Number of men in crew	
				Bay operation	Outside operation
	(*Meters*)		(*Winch*)		
Philippines:					
Baby trawl	6–10	5–12	None	2–3	
Small	11–20	13–40	Port and starboard roller	4–6	8–10
Medium	21–30	41–60	Port and starboard or double roller.	8–10	14–16
Large	31–35	61–94	Port and starboard or double roller.	10–12	14–16
Stateside:					
Louisiana	21–36	35–40	Triple drum	3–4	
New England:					
Small	21–30	10–50	Single drum	3–5	
Medium	31–39	51–150	Double drum		12–14
Large	40	151 over	Double drum (single shaft)		15–17
Western combination boats:					
Small	11–20	15–30	Port and starboard drum (Rowe type) double drum.	3–5 (Dragging) 10–12 (Seining)	4–6 (Dragging) 12–14 (Seining)
Medium	26–30	30–80	Combination winch (northern dragger type).		

The crew of trawlers are generally paid on the daily basis. Sometimes when good catches are obtained, from 2 to 5 per cent of the gross return is given away by boat owner as bonus to the fishermen. The relative pay rates of the crew of a typical trawler may be seen in the prospectus for a small otter-trawl venture at the end of this paper. It is a universal practice now among trawl operators to suspend the day's wage of the crew when the vessel is not fishing. However, the watchman and/or the engine crew gets the regular daily wage if he is doing any repair or overhauling job of the engine.

The share system of paying the crews from the catch-return of a fishing vessel has not gained much foothold among trawl boat owners, although this is the common practice in other Philippine commercial fishing gear, like the *sapiao*, the *baklad*, the *basnig*, and the *talakop*. The usual sharing system in the operation of this native fishing gear is on the "50–50" basis of the net return, that is, 50 per cent goes to the fishermen and 50 per cent goes to the owner of the vessel. Lately, however, a number of small and medium trawling operators have adopted the share system.

THE VESSELS

Before the war the Japanese two-masted sampan type of vessels, designed and built by Japanese boat builders in Manila,

were the standard type of fishing craft used here. During World War II almost 99 per cent of the 130 beam trawlers were either burned or sunk, and after liberation various kinds of locally available vessels came into use. In 1945 only two beam trawlers (utase) were in operation in Manila Bay and one or two in Iloilo. Because of the large profits being realized then from trawl fishing, every type of available vessel was placed in this industry. Except for a few salvaged and newly constructed sampan vessels, the main bulk of the trawling fleet in 1947 and 1948 came from the surplus craft of the United States Army and Navy in the Philippines. Since the early part of 1949, numerous construction of a promising type of vessel, the combination or general utility type, have been in rapid progress in Negros and Panay. This idea of a combination type of fishing vessel, which is a distinct development of the West Coast of the United States, has been under serious consideration and study by a group of American and Filipino fisheries men who conducted the first fishery rehabilitation survey in the Philippines from April to September, 1946, under the auspices of the U. S. Department of the Interior.

TABLE 6.—*Otter trawl boats showing specifications of craft, gear and accessories used in the fishery (1950).*

Specifications	Classes of other trawl vessels			
	Baby trawler	Small trawler	Medium trawler	Large trawler
Fishing vessel:				
a. Number of units	8	86	14	21
b. Length in meters	6–10	11–20	21–30	31–35
c. Gross tonnage	5–12	13–40	41–00	61–97
d. Net tonnage	5–18	8–18	18–35	30–90
e. Horse power	60–225	70–225	120–240	240–450
Size of net in meters:				
a. Footrope	10.0–12.0	21.0–25 m.	26.0–30.0	31.0–40.0
b. Headrope	7.0–10.0	16–20.0	21.0–25.0	26.0–35.0
c. Length of net	15	20	25	3.0
Size of otter door in meters:				
a. Length	1.00–1.20	1.30–1.50	1.50–1.70	1.30–2.80
b. Width	0.6 –0.76	0.91	0.91	1.0
c. Thickness in cm (Planking)	1.75	2.5	2.5	3.5
d. Weight in kilos (approximate)	25.–30	35–45	45–65	65–115
Number of rock weight on footrope:[a]				
a. Wings (Nos. 1 and 2)	20.30	60.70	70–80	90–100
b. Center (Nos. 2 and 3)	5–10	10–15	15–20	20–25
Chain weight on footrope (kilograms):				
a. Wings	5–10	15–20	25–30	35–40
b. Center	2–3	2–4	4–6	8–10
Number of glass floats on headrope:				
a. Wings (10 cm. dia.)	10	40–60	64–76	80–90
b. Center (12–15 cm. dia.)	6	8	10	12
c. Bag (20 cm. dia.)	2	6	8	8

[a] Rock and chain weights are sometimes replaced entirely by 5 oz. lead weights or combination thereof.

Incidentally, the writer was then a member of this preliminary rehabilitation survey party.

As to size and tonnage (Tables 5 and 6) the vessels used in the trawl fishery may be classified into four categories, namely, (1) baby trawl, the smallest, a motor launch 6 to 10 meters long, of 5 to 12 gross tons; (2) a small sampan-type, 11 to 20 meters long, of 11 to 20 gross tons; (3) a medium trawler 21 to 30 meters long, of 41 to 60 gross tons; and (4) large trawler, 31 to 35 meters long, 30 to 97 gross tons. Propulsion power is, for the most part, supplied by diesel engines, ranging from salvaged Japanese semidiesel, of 70 to 115 horsepower, to a popular American high-speed Gray marine engine of 225 horsepower. A few vessels are, however, powered with medium and low-speed diesel engines of from 100 to 240 horsepower. There are also a few which are provided with twin diesel engine of 225 horsepower each. It will be noted here that the majority of postwar trawler are not only heavily powered but comparatively more efficient than their prewar counterpart, which were provided from 20 to 70 horsepower Japanese diesel engine (Umali, 1932).

A typical utase boat converted into an otter trawler (fig. 2) is a two-masted vessel with the wheelhouse located almost amidship. The foremast and aftermast serve for the drying of fishing nets. The foredeck is clear for sorting, traying and icing of the catch and the clear space aft for the operation of the gear. The deck rigging consists of a pair of forward towing bitts, set on each broad and starboard bow. Another pair of aft bitts is installed on each broad on starboard and portside quarters. The "T" stanchions and brailing frames (fig. 3) are peculiar features of the Philippine otter trawl vessels; these are used for securing the otter doors and for brailing the catch, respectively. This system of rigging to the foreign fisherman may appear clumsy, but they are very economical to install especially on wooden vessels.

The winch consists of a pair of port and starboard rollers, or gypsy heads which is connected by a horizontal shaft mounted above the engine coaming just behind the pilot house. It is driven by a set of bevel gear from a power take-off to the main or an auxiliary engine. Back of the pilot house are the sleeping quarters, followed aft by the pantry and galley. The clear space forward on deck is used for sorting, traying and icing the catch and the space aft for the shooting and hauling in of the otter trawl gear.

A number of recent variations from this typical trawler are found in newly constructed combination type of vessels and on some reconverted tugboat type of vessel. Here the deck arrangement is patterned after the Western type of fishing vessels commonly used along the West Coast and the Gulf States of the United States.

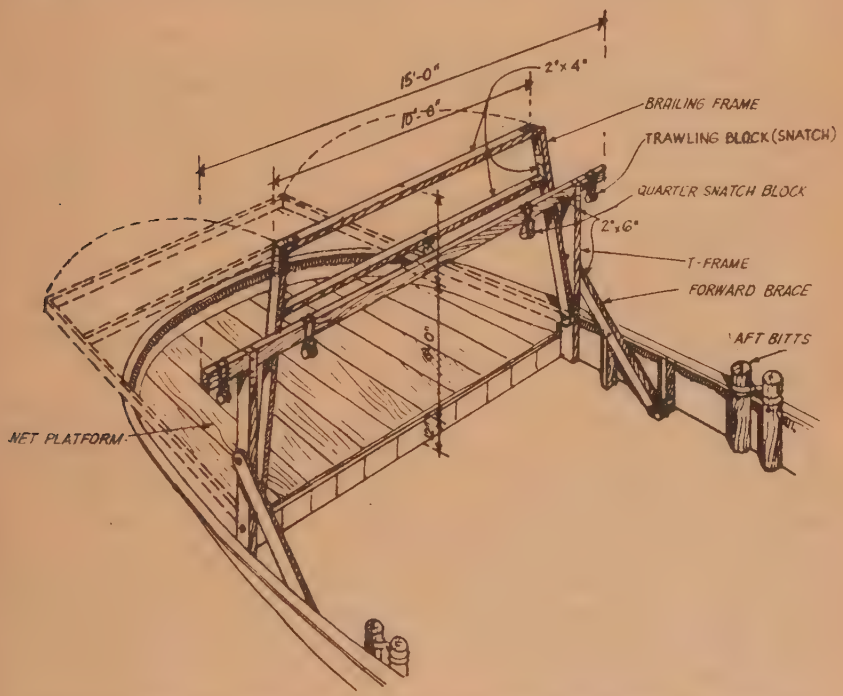


Fig. 3. T "stancions" and brailing frames of a Philippine otter trawler (diagrammatic).

The characteristic feature of this type is the much forward location of the wheelhouse and the deck aft the mast is clear for the operation of a wide variety of fishing gear. Some vessels of this type install the Philippine "T" stanchion and brailing frames at the stern while the more progressive operators use the stout mast and boom rigging for efficient hauling-in of the gear and landing the catch. Others use the stern davit made of heavy-duty G. I. iron pipes with regular trawling blocks (fig. 3*a*). In Negros and Iloilo the trawlers commonly use an inverted L post of heavy wooden beam for the stern stanchions.

In this modern type of rigging cable trawling, wires are generally used. These are spooled in double-drum winches

which are mechanically driven by power transmission from the main engine. On the whole, this rigging is more efficient than the other system as every phase of the fishing operations are operated by a relatively small number of men in the crew with the aid of mechanical devices. Various systems of deck arrangement and rigging otter trawl vessels are shown in figs. 4 and 5.

In 1950 other notable developments in the otter trawl fishery occurred. Significant among these is the introduction of a small type of trawling craft, the "baby" trawler, and a 100-foot Eastern type of trawler, the side-set trawl. These baby trawlers are typical replicas of the small shrimper or luggers of Louisiana and Florida in the Gulf of Mexico. They range from 20 to 36 feet long, about 3 to 5 tons gross, and powered with from 30 to 40 horsepower gasoline or diesel engine. The rigging is simple and inexpensive. There are no powered winches and the entire fishing operation is undertaken by two to three men at most.

In the later part of 1952 another significant development of the trawl fishery occurred in Manila Bay. This development consisted of the conversion of the native dugout, equipped with a small gasoline engine for trawling at depths from one to five fathoms. In effect it is an improvement over the age-old hand-operated scissors shrimp net (*sakag*). At present there are reported several hundred units in operation in Manila Bay. The industry is fast gaining popularity among the small independent fishermen.

THE OTTER TRAWL GEAR

The otter trawl fishing gear may be divided into three main parts, namely, the trawl warps, the otter door, the net proper and gear accessory.

The trawl warps and bridle connections (*fig. 6*).—The typical trawl warps used in the Philippine otter trawl gear consist of a pair of Manila (abaca) ropes of even length. Each trawl warp measures from 720 to 900 feet long and varies in size from 7/8″ to 1–1/4″ diameter, depending upon the size and power of the vessel. Hardlaid towlines are generally preferred as they appear to last longer than the softer lays. As a rule, abaca towlines last from three to five months at most under continuous usage.

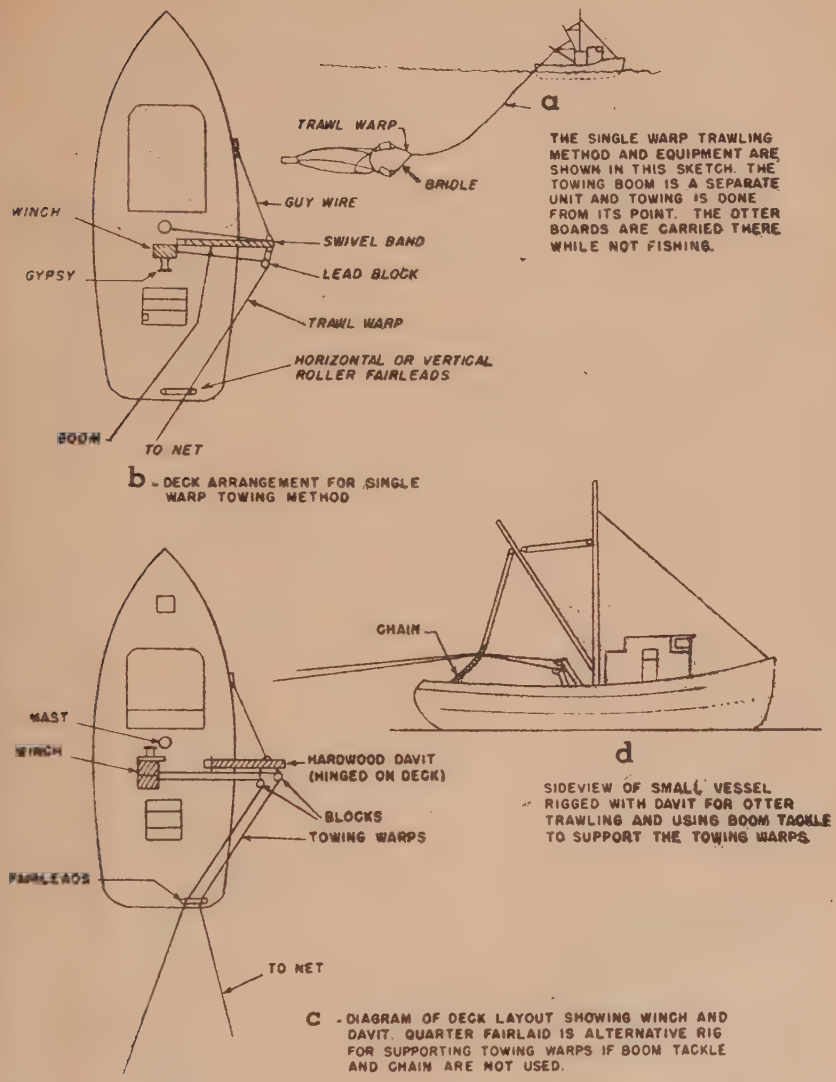
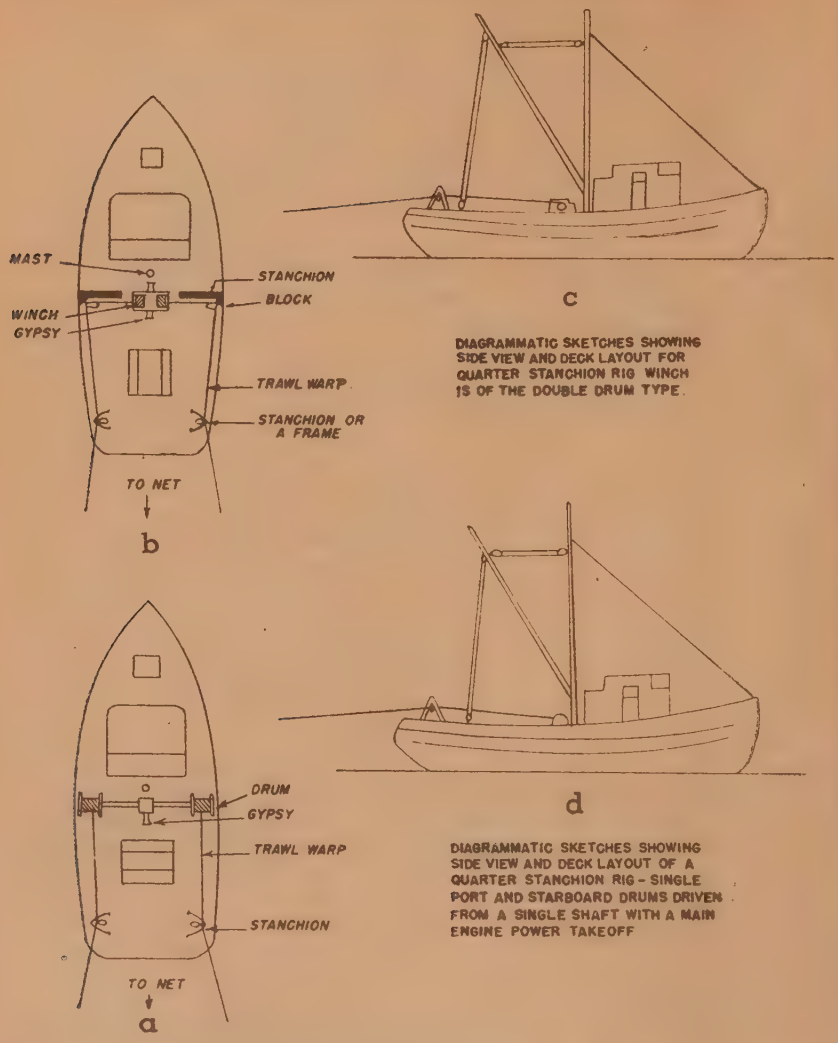

a
TRAWL WARP
BRIDLE
THE SINGLE WARP TRAWLING METHOD AND EQUIPMENT ARE SHOWN IN THIS SKETCH. THE TOWING BOOM IS A SEPARATE UNIT AND TOWING IS DONE FROM ITS POINT. THE OTTER BOARDS ARE CARRIED THERE WHILE NOT FISHING.
WINCH
GUY WIRE
SWIVEL BAND
GYPSY
LEAD BLOCK
TRAWL WARP
HORIZONTAL OR VERTICAL ROLLER FAIRLEADS
BOOM
TO NET
b - DECK ARRANGEMENT FOR SINGLE WARP TOWING METHOD
CHAIN
d
SIDEVIEW OF SMALL VESSEL RIGGED WITH DAVIT FOR OTTER TRAWLING AND USING BOOM TACKLE TO SUPPORT THE TOWING WARPS.
MAST
WINCH
HARDWOOD DAVIT (HINGED ON DECK)
BLOCKS
TOWING WARPS
FAIRLEADS
TO NET
c - DIAGRAM OF DECK LAYOUT SHOWING WINCH AND DAVIT. QUARTER FAIRLAID IS ALTERNATIVE RIG FOR SUPPORTING TOWING WARPS IF BOOM TACKLE AND CHAIN ARE NOT USED.

FIG. 4. Deck arrangements on small trawling vessels (under 50 feet long) usually adopted in the Gulf State of the United States of America (diagrammatic).



Text Fig. 5. Deck arrangements on large trawling vessels (over 50 feet long) usually adopted in the Pacific Coast of the United States of America (diagrammatic).

In operation the arrangements and connections of the trawl warps and the rest of the fishing gear is as follows: Each warp is secured at one end to a pair of forward bitts on board the towing vessel and the net-end to the bridles of the corresponding otter door. A swivel-shackle arrangement connects the net-end of the warp to the otter door. To each otter door is a 6-foot abaca bridle (door strap) of about the same size as the sweeprope and secured on eyebolts set at the last quarter points of the nether surface of the door. To this door

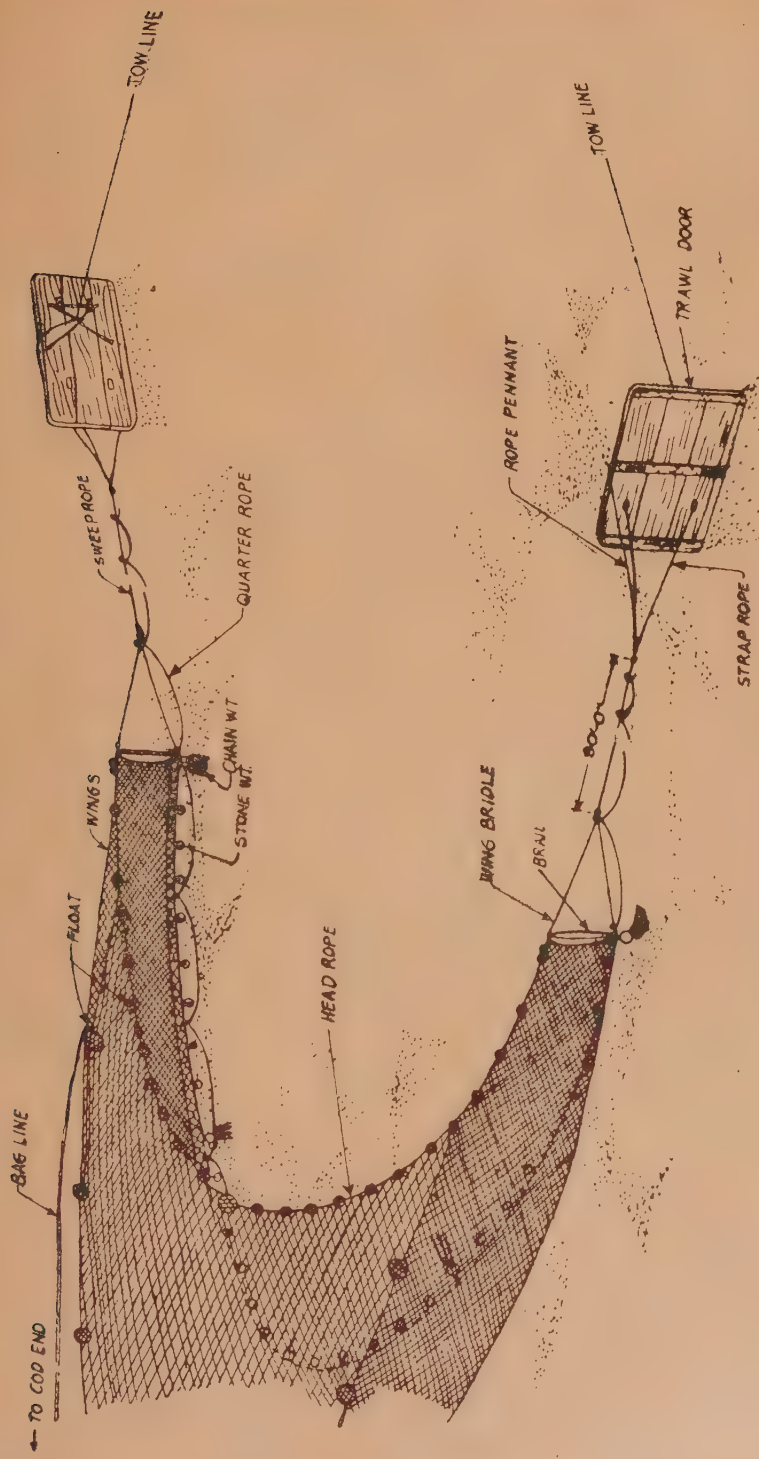


FIG. 6. Trawl warps and bridle connections, Philippines otter trawler (diagrammatic).

strap is shackled the sweeprope. The net-end of the sweeprope is connected to an 8-foot wing bridle of about the same size as the sweeprope. The forward ends of the footrope and headrope of the net proper are then connected to the corresponding wing bridles. The wing brails, or "Dhanlenos", one on each forward end of the wings, are secured by a Japanese knot on the head and footrope of the net.

Trawl warps before use are properly uncoiled, stretched, and marked to insure efficient fishing operation. The usual marking consists of a 3-ply whipping of abaca twine set at 20- or 25-fathom interval.

Some trawlers provided with drum winches use plain flexible cable wires for trawl warps. This type of warp is usually marked by brightly colored paints and/or abaca or cotton whippings. A more durable trawl-warp marker consists of frayed wire thread of the same wire tucked into the strand. The usual size of wire used is a ½" diameter, 6 by 19 cable. Most beam trawlers, however, use a similar flexible cable wire of 5/8-inch diameter. This flexible wire is served in its entire length with a 3-ply abaca twine and then treated with coal tar. The latter two kinds of trawl warps are considered much better than the pure abaca warp for they last much longer and therefore are economical in the long run. They last for a year or two while the pure abaca warps last only for about six months.

The otter doors.—The otter doors, or simply called locally "boards", are always used in pairs consisting of a left and a right-hand door. The Philippine version of the otter door (fig. 7) which was originally designed by the writer for use of the commercial trawler varies from 1.0 to 2.8 meters long and 0.6 to 1.0 meter wide depending upon the size of the net and power of the vessel. Tables 6 and 7 show the relative sizes and weights of boards, nets and accessory warps as used in the commercial otter trawl fishery.

TABLE 7.—*Specifications of abaca (Manila) and flexible wire rope commonly used in the Philippine trawling gear.*

Parts of gear		Baby trawl		Small trawl		Medium trawl		Large trawl		Remarks
		Diameter	Circumference	Diameter	Circumference	Diameter	Circumference	Diameter	Circumference	
English:	Tagalog:	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	
Abaca trawl works	Remorke	¾–⅞	2¼–2¾	1.0–1⅛	3–3½	1.0–1¼	3–3¾	1 5/16–1½	4–4½	Hard laid
Bag line	Ayuda sa supot	⅝	2	⅝	2	¾	2¼	none	none	Medium laid
Bending rope	Panghanay	¼	¾	¼	¾	¼–5/16	¾–1.0	none	none	ditto
Buoy line	Lubid sa buya	⅜	1⅛	⅜	1⅜	⅜–5/16	1 1/16–1¼	⅜–7/16	1⅛–1¾	ditto
Doorlegs and ground cable	Parisukat sa board	⅝–¾	2¼	⅞–1.0	2¾–3	1.0–1¼	3.0–3¾	1¼–1 5/16	3¾–4.0	ditto
Flexible trawl warps	Remorke					½	1½	½–⅝	1½–2.0	6 x 19 6 x 37
Foot rope	Lawayan sa bato	⅞–1	2¾–3	1¼	3–3¾	1¼	3¾	1⅛–1½	3½–4½	Medium laid
Head rope	Lawayan sa buya	¾–⅞	2¼–2¾	⅞–1.0	2¾–3.0	⅞–1.0	2¾–3.0	1.0	3.0	ditto
Glass float rope	Pambuya	¼	¾	¼	¾	¼–5/16	¾–1.0	5/16	1.0	ditto
Quarter rope	Ayuda sa lambat	none	none	⅝–¾	2.0–2¼	⅝–¾	2.0–2¼	⅞–1.0	2¾–3.0	ditto
Lock and chain weight rope	Pamato	⅜	1⅛	⅜	1⅛	⅜	1⅛	⅜	1.0–1⅛	ditto
						5/8–¾	2.0–2¾	¾–1⅛	2¼–3½	
Tackle and guy lines	Pangalo			⅝–¾	2.0–2¼	½–¾	1½–2.0	½–⅝	1½–2.0	ditto
Wing bridles	Parisukat sa pakpak	¾–⅞	2¼–2¾	1.0–1 1/16	3.0–3¼	1.0–1 1/16	3–3¾	⅞–1	2¾–3.0	ditto

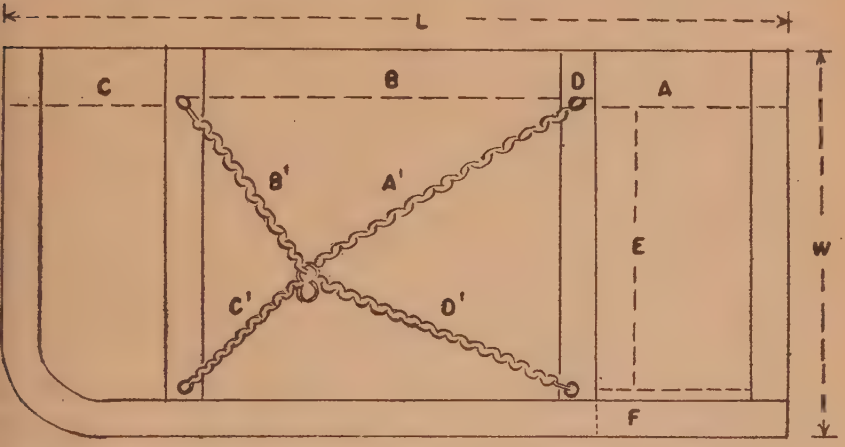
A typical door is made from 1″ to 1½″ planking of a combination of medium and hard wood. The first two upper planks are made of medium wood, preferably *palusapis* (*Anisoptera thurifera*) and the lower plank, *guijo* (*Shorea guiso*). The iron shods or runner edge are made of ⅜ to ½″ by 3 to 4″ plate bolted together along the runner edge of the door. The bridles consist of a forward triangular iron rod bracket about ½″ to ¾″ in diameter and the after bridle pass through chain holes on the upper and lower edge of the midbrace of the door and are held in place by a cross pin or bolt. This arrangement facilitates an easy adjustment of the chain bridles. Each board including bridles and chain weighs from 25 to 115 kgs., depending upon the depths of the fishing ground and power of the vessel. It is evident from Table 7 that the bigger and heavier doors are used for correspondingly bigger nets and employs more powered vessel. As a general rule, the proportional length of the board is usually made about 10 per cent of that of the headrope of the trawl net.

The proper adjustment of the door bridles is a determining factor in the proper operation of the otter trawl gear. While master fishermen and fishing captains have different ideas of door adjustment, which depends upon fishing conditions, nature of bottom and system of bridle arrangement, there seems to be some underlying basic principle in the rigging of a door. This principle has been the basis of the rigging of the Philippine otter door.

The adjustment is done by quartering the door. At the forward quarter the triangular iron bridle is held in place by two pieces of iron plates which are bolted through the door. The apex of the triangular bridle when laid flat against the door should fall at a point one inch below the horizontal midline of the door. At the aft quarter the door straps are shackled through eye bolts set on the upper and the lower edge on the back side of the door. The two ends of the after bridle chains are then passed through board holes on the upper and lower edge of the midbrace of the door. The "focal center" of pull is ascertained by dropping a plumb bob from the apex of the forward bridles and marking the forward bridle, the stretched length of the chain bridles are adjusted and held in place by an iron rod or bolt set across a taut link on the back side of the door. The apexes of the forward

and after bridles are shackled together to a swivel to which the towing warp is connected. In operation, this adjustment will approximately give a 45-degree angle of a glide and a normal spread of from 20–28 meters (50 to 60 per cent of the length of the footrope) between the two doors which is considered the most effective fishing width of this gear.

In 1950 the Philippine Bureau of Fisheries conducted a survey of the various adjustments of the door bridles as used in the commercial otter trawl fishery. The mean value of each proportional measurement of the bridle adjustment was taken and converted into percentage (fig. 8). It has been noted that wide variations of adjustment of the bridles of operating otter doors were in use even in the same locality.



Ratios:
W:L A:L a:L d:L
C:L D:W b:L
B:L E:W c:L

FIG. 8. Diagram of a commercially operated otter door showing the basis of computation of percentage proportions of the briddle arrangement.

Experience has, however, shown that these variations in adjustment of the door bridle depends, in a large measure, upon the type of rigging of the net to the door, nature of trawling ground, weight of door, and possibly depth of the water. No study was made on the effects of these determining factors.

In the latter part of 1949 a lighter type of board was introduced by the fishery trainees[3] from the Gulf States (fig. 9). While the bridle attachment differs from the Philippine version of the otter door, the fixing of the focal center of the board is practically derived from the same principle.

[3] Fishery students trained in the United States of America under the Philippine Rehabilitation Program by the Philippine Rehabilitation Act of 1946, Title 50, App. U. S. Code, section 1789.

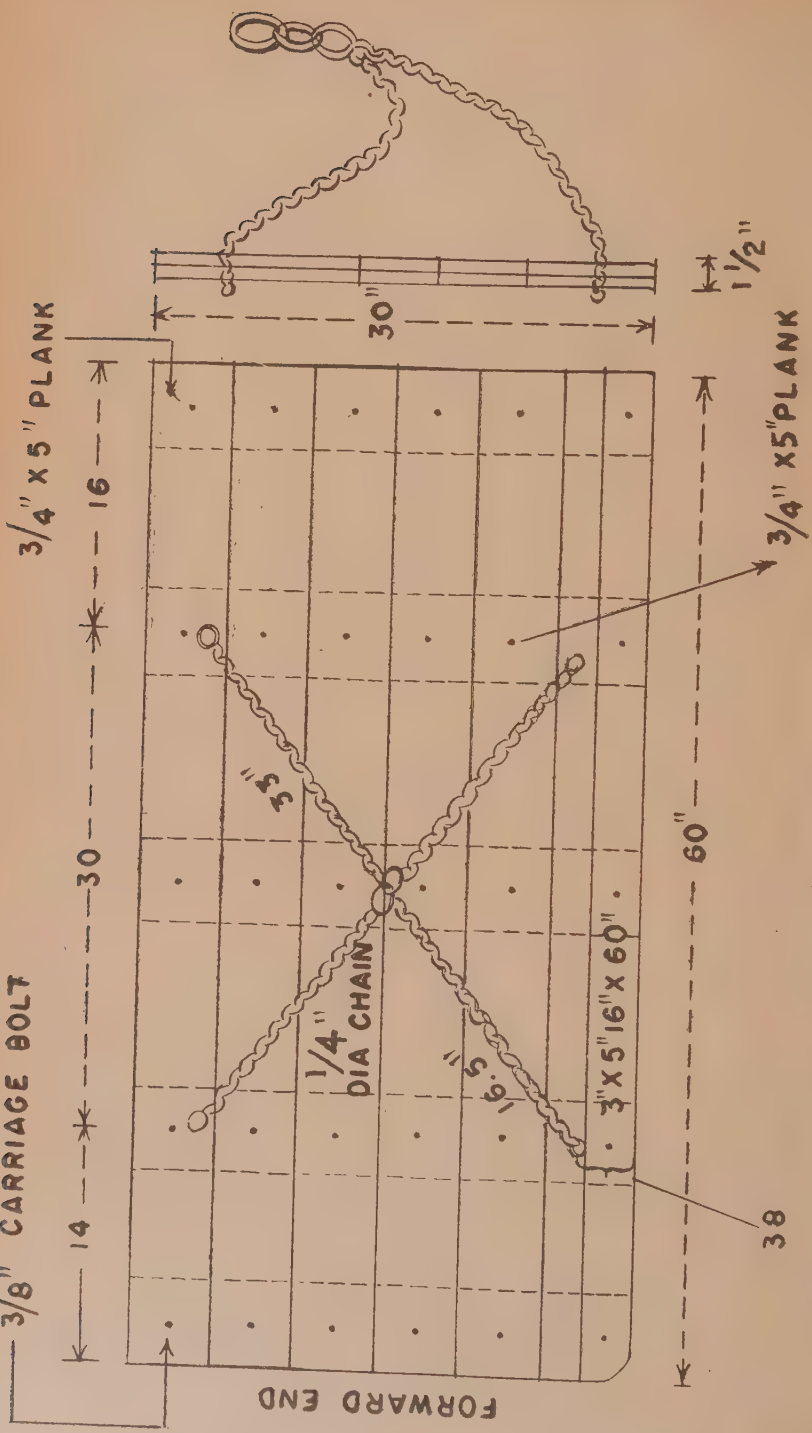


Fig. 9. Diagram of a Louisiana-type of otter door (light type) suitable for a 70-foot headrope net. Each weighs approximately 35 kgs.

This board seems adaptable for shallow-water dragging especially for the operation of small, shrimp-type of nets. A heavy type of door introduced from the West Coast was used for otter trawl explorations of Philippine waters jointly conducted by the Philippine Bureau of Fisheries and the United States Fish and Wildlife Service (fig. 10). This heavy type of door was found suitable for deep-water trawling here but was found inconvenient for use by most commercial trawlers. The reason is quite obvious on account of the relatively limited hauling capacity of locally built winches and the shallow nature of most trawling grounds.

Otter door hook-ups (*fig. 11*)—Two systems of otter door hook-ups are in use in the commercial trawl fishery dandyline and double-leg Manila line hook-ups. For baby and small trawlers, the double leg Manila line hook-up is commonly employed. This is a system adopted from the shrimp draggers of the Gulf States of the United States of America. The extension of the head and foot rope (one to one and a half meters long) to the upper and lower edges of the otter doors are used as legs, respectively. For medium and large trawlers the dandyline hook-up is commonly used. This is made either of a pair of ⅞″ to 1″ diameter Manila rope or ½″ diameter flexible cable, ranging from 20 to 50 meters long (10–25 fathoms). This is a Western and Eastern Seaboard adoption from the United States.

The net proper (*fig. 12.*)—Two commercial designs of trawl nets are in general usage in the Philippine otter trawl fishery—the modified Pacific or simply called Philippine trawl net and the modified Japanese utase type, commonly called the "mestizo". Both types are typically four-sided nets, the difference being in the mode of cutting, size of mesh and thread used, and the proportional measurement of the various parts. Most of these trawl nets are made from handwoven webbing knitted to desired sizes of meshes. Flat knot is the common system of net knitting used, it being a locally established and faster method. Trawler's knot should, however, be preferred especially for trawl nets because the knots stay fast. Most of the trawl nets are made and distributed by one or two local fishing supply firms in Manila.

These two types of nets are assembled and hung in practically the same way. In bending the four body pieces are joined along four seams, each properly reinforced with a ½″ or ⅝″

diameter cotton rope ribbing. The advantage of the four ribbings is that it confines tear on one face of the net and facilitates emergency repairs at sea.

The flapper is a common feature of the two commercial types of trawl net used in the fishery, even though it is no longer used in most Western and Eastern trawl nets. The idea of the flapper in the local trawl nets is to prevent the escape of the fish from the much shortened bag, not during dragging, but purposely during hauling operation.

In operation each type of net uses from 10 to 90 glass floats and from 20 to 100 rock weights. The glass floats are attached along the headrope, the distance varying from a foot at the center to 3 feet toward the wing end. The rock weights are attached to the entire abaca footrope, the smaller sizes set along the center and the bigger ones toward the forewing. The distance of the rock weights varies from half a foot at the center to 1-½ feet toward the forewing. Five bunches of chain weights are attached to the entire footrope, namely, two pieces of 3 to 5 kilos each set at the base of each forewing; two pieces of 2 to 3 kilos each set at the junction of the wing and belly and one 3-kilo piece stretched out in an arc along the center bosom of the net.

The Philippine trawl net (*fig. 13*).—This is the first post-liberation commercial otter trawl net used which was originally designed and commercially tried by the writer. It is typically a modified four-sided trawl net originally used on the West Coast of the United States. The following are the specifications of a common 100-foot net with a headrope of 85 feet and about 90 feet long:

Part	Mesh inches	Length feet	Thread
Wing	2½–3	35	12–15
Top	2	30	15
Bottom	2	20	15
Bag	1⅜–1½	25	18–21

The salient feature of this type of otter trawl net is the short wing, much reduced square, and short flapper. The bag is cut into four rectangular pieces and joined along four seams. Here the four body ribbings are extended to the rim of the cod-end for attachment of glass floats. This type of trawl net, on the average, consumes from 200 to 250 meters (100 M.D.) of webbing compared with 250 to 300 meters as

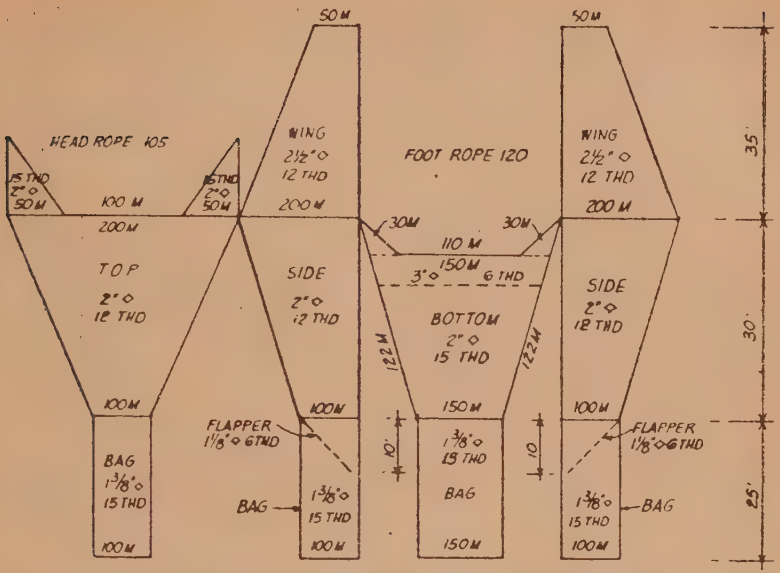


FIG. 13. Diagram of a typical Philippines otter trawl net.

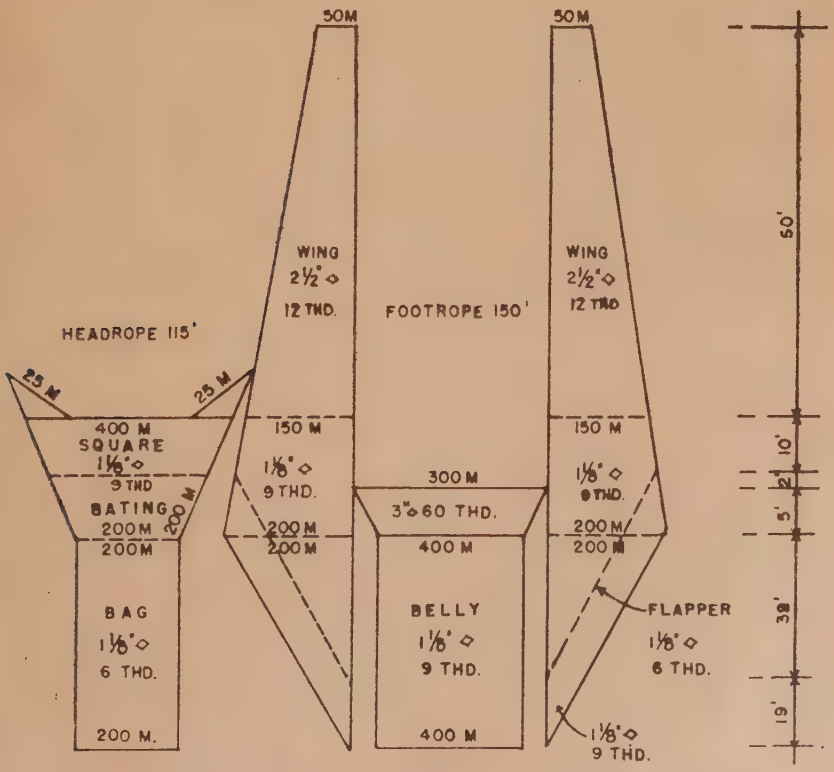


FIG. 14. The "Mestizo" trawl net (diagrammatic).

used in the "mestizo" (described below) trawl net for an equivalent size requirement of a trawling vessel (Table 8).

TABLE 8.—*Comparative operating costs and gear requirements of an average commercial utase and other trawler in Manila Bay (June, 1949).*

Operational data	Utase trawler	Otter trawler
Daily operating cost, pesos	150 to 200	120 to 150
Overall length of vessel, meters	14 to 22	12 to 225
Gross tonnage	12 to 40	12 to 40
Horse power of main engine	70 to 240	[a] 70 to 225
Number of men in crew	8 to 12	6 to 10
Size of net (footrope), meters	35 to 45	28 to 3
Netting used per net (100 M.D.), meters	250 to 300	200 to 2

[a] Light duty

According to random observations, corroborated by reports of master fishermen of otter trawlers, the catching efficiency of the two designs of net are practically the same. However, the Philippine trawl net is more efficiently handled especially in the hauling operation. The baggy cod end of the mestizo trawl net is clumsy to strap during hauling operation and relatively heavier to drag on account of the finer size of mesh used.

The "mestizo" trawl net (fig. 14).—This type of trawl net, which is a modified version of the Japanese (utase) net, is characterized by extra long wings forming almost two-thirds of the entire length of the net. It has a distinctly short body and a big roomy bag. The overhang or square extends to two-thirds the length of the wing.

The following are the specifications of a typical 150-foot net with a headrope of 120 feet:

Part	Mesh inches	Length feet	Thread
Wing	2.5–3	45	12–15
Top	1.5	38	9
Bottom	2–4	15	9 and 60
Bag	1–1.5	25	6–9

As will be noted in the foregoing specifications, the sizes of the mesh are generally smaller and the thread lighter than the corresponding parts in the Philippine trawl net. There is only one possible advantage claimed by trawl operators of the mestizo net over the Philippine trawl net in that the the roomy bag of the former produces a better quality of the catch than in the narrow congested bag of the latter. It is

claimed that the impounded fish gets massed in the narrow cod end of the Philippine trawl net, especially in prolonged drags of from three to four hours. Lately, however, this defect of the Philippine trawl net was remedied by enlarging the bag.

In all appearances the present commercial trawl gear used are by no means standardized. The nets are undergoing some changes, in form and in sizes of thread and meshes in accordance with the ideas of the individual fishermen. Boat rigging and hauling operation as well as net designs and construction are up to some drastic changes in the near future because of the entrance of young trained men who recently returned from and learned latest technique of dragging in the United States. These prospective progressive operators would not stick to precedents and could easily adopt improved techniques in the fishery.

With the introduction of the lighter board from the Gulf States, a corresponding type and design of net came into general usage, the Florida baloon (fig. 15). This is a comparatively small and light type of net especially adopted for small vessels, employing two to three men. This was experimented by the Philippine Bureau of Fisheries and has been adopted lately by some of the "baby" and small trawlers in Lingayen Gulf, Negros and southwestern Samar, and Tayabas Bay.

FISHING OPERATION

Trips and ice load (*Table 9*).—As to area of operation two kinds of fishing trips—"bay" and "outside" trips—are made by the commercial trawlers. Generally, the "bay" or small trawlers are confined to bay operation, and the medium and large trawling vessels to outside operation. The later two types of vessels can operate on a year-round basis outside and inside Manila Bay as they are least affected by the prevailing monsoons. In Manila Bay, an average trip covers from 1 to 2 days while those operating outside 10 to 15 days. Trawlers operating outside go as far as 300 miles from the homeport of Manila to the coastal fishing areas of southwestern Samar, southern Masbate, off Estancia, and northern Capiz. On account of recent decline in trawl catches the duration of the fishing trips has been prolonged to 3 days for bay trips and to about 20 days for outside operation.

Trawlers operating in Manila Bay or nearby areas usually carry from five to eight blocks of ice (300-lb. block each).

The outside trawlers, on the other hand, carry from 20 to 25 tons of crushed ice. About half this weight in fish is expected as a normal trip's fare. Only two trawlers are known to be carrying from 5 to 10 tons of crushed ice because partial mechanical refrigeration is used in order to keep the ice from thawing.

TABLE 9.—*Duration of fishing trips and ice load of trawling vessels in trawling centers in the Philippines.*

Areas	Fishing trips	Ice load
	(*Days*)	
Manila Bay and approaches	1–3	3– 5 (300-lb. block).
Iloilo City	4–6	5–10 (100-lb. block).
Bacolod and Silay, Negros Occidental	1–2	10–15 (300-lb. block).
Capiz, Capiz and Estancia, Iloilo	1–2	4– 8 (100-lb. block).
Calabanga, Camarines Sur and San Miguel Bay	1–2	3– 4 (300-lb. block).
Aloneros, Tagkawayan and Ragay Gulf	1–2	4– 6 (300-lb. block).
Lucena, Quezon and Tayabas Bay	2–3	10–20 (300-lb. block).
Damortis and Dagupan Lingayen Gulf	1–2	4– 6 (100-lb. block).
Catbalogan, Samar, Maqueda Bay	Overnight (baby trawlers).	No ice load.
Southwest Samar (Asid Gulf) (Manila trawler)	14–20	12–18 tons.

The ice load of trawling vessels depends upon the length of fishing trip, abundance of fish, and the fishing area.

Table 10 shows a reference list of accessories and supplies needed by a commercial trawler for "lay" and "outside" fishing operations. These are minimum requirements to forestall any contingency during the trip.

Methods of fishing.—Unlike pelagic methods of fishing where the net is set in actually seen fish, the otter trawl, as a rule, is set blindly or by "hunch". In the Gulf States, however, the shrimp otter trawlers use a trial net (Anderson et al., 1948) for locating the concentration of shrimps. This trial net consists of a miniature otter trawl about 10 feet wide usually set on the port-side through an amid-ship davit prior to the shooting of the main net. More often this net is shot and hauled at intervals during actual fishing operation to guide the course of the vessel to the concentration of shrimps.

In the Philippines the usual methods of locating fish and shrimp concentration are by 'hunch" and by short trial drag with the use of the main net. Others work in accordance with the state of the tide and seasons. Still others use a zigzag course of dragging, which many fishermen have claimed to

yield good results. Operations of native fishing gear, such as seines and gill nets, also serve as guides to possible bottom-fish conservation. Of recent development is the fathometer (fish finder) which serve both as guide to fish concentration and good and smooth trawling ground. At the time of writing, not even one commercial trawler has installed a fathometer; only the Bureau of Fisheries research vessels have them.

TABLE 10.—*List of accessories and supplies needed by a commercial trawler in a fishing trip.*

Kind	Bay operation (1 to 3 days)	Outside operation (10 to 15 days)	Remarks
Diesel fuel	100–300 gal.	1000–1500 gal.	Carry maximum load.
Gasoline	5–10 gal.	5–10 gal.	------do------
Lubricating oil	10–20 gal.	50–100 gal.	------do------
Ice (300 lbs.)	5–10 blocks	10–150 blocks	Crushed.
Fresh water	100–200 gal.	300–500 gal.	Carry maximum load.
Set of nets	Two sets	Three sets	
Grub:			
Rice	100 lbs.	200 lbs.	Weekly consumptions.
Viands	₱1.00	₱1.50	Per person per day.
Cigarettes	One "pack"	One "pack"	Per person per day.
Banyera	None	200–300	G.I. cans.
Fish trays	100–150	None	
Baskets	9	10– 15	50 kgm. capacity.
Do	5–10	5–10	20 kgm. capacity.
Bistay	6	10	Fish sorting.
Fish shovels	2	6	------do------
Rubber boots	3 pairs	8 pairs	knee-boot type.
Glass buoys	100 pcs.	150–200 pcs.	4" diameter.
Rock weights	100 pcs.	150–200 pcs.	Nos. 1, 2 and 3
Chain weights	5–10 kgm.	15– 20 kgm.	⅜" size
Thimbles	12 pcs.	24 pcs.	1" size
Swivel	4 pcs.	6 pcs.	⅝" size
Shackles	12 pcs.	24 pcs.	½" size
Ropes (Sweeprope)	30 kgm.	50 kgm.	⅞" diameter
Rock wt. rope	10 kgm.	25 kgm.	⅜" diameter
3 ply twine	2 balls	5 balls	
Bag rope	20 lbs.	50 lbs.	½" diameter
Mending twine	5 lbs.	10 lbs.	6 and 9 Hand

Shooting the net (*areada*).—Like all stern-set otter trawls, the Philippine otter trawl gear is shot over the stern between the A- or the T-stanchions. Two men usually handle the shooting operation. The shooting sequence of the net is as follows (fig. 16):

After the projected course has been properly plotted or determined, the vessel is brought to a slow speed ahead. The tail buoy is first payed out, followed by the cod end, body, wings and sweepropes. As the net hits the water the rest of the gear follows through the "wash" of the vessel. The fore part of the sweeprope which has been previously secured on the after bitts stretches out the net as well as insures its proper action in the water. If the net is "clear" the sweepropes are gradually released while the otter doors are being readied.

Prior to the releasing of the two doors the vessel is given a moderate speed ahead until the sweepropes become taut on the door straps. Then the doors are gradually lowered simultaneously to the water by releasing the trawl warps but keeping them taut through the forward towing bitts. As the doors hit the water they spread out away from the quarter sides of the vessel. More trawl warps are payed out gradually until the desired length is reached at which time the vessel should be slowed down in order to properly secure the warps on the forward towing bitt. When the warps are secured they are "slack off" by further slowing or stopping the vessel so that the warps may be removed from the trawling blocks. This is done in order to facilitate an easy turning of the vessel during the dragging. A guide rope is "looped over" each towline secured on each aft bitt. This guide line keeps the fouling off of the towlines in the screw of the vessel especially when making turns during dragging operation.

Hauling the net (*cobrada*).—The hauling of the net is usually done aft wind in order to minimize its fouling under the vessel. The entire hauling operation is illustrated in fig. 17. When the drag is completed the vessel is stopped or reversed when there is a strong aft wind and sea. The winches are started and hauling commences. The guide ropes are hauled in and released from the warps. They (warps) are "tucked in" the trawling snatch blocks and fairleaded to the winch rollers or gypsy heads located on each side of the pilot house. The warps are hauled in at the same time and coiled separately on each side of the foredeck. A forward "kick" is given the screw every now and then to keep the vessel away from the door and net.

As the doors "break out" of the water and reach the stanchions they are secured by a chain hook or a short securing rope. The haulback lines are retrieved and with a back kick of the vessel the sweepropes are slacked off. Then these ropes are "tucked in" the snatch blocks and fairleaded to the winch rollers. As the sweepropes are hauled in they are coiled separately on each isle near the aft bitts. The ends of the quarter ropes (*ayuda sa lambat*) which are clove-hitched on the last third of the sweepropes are unwound and handled separately by one deckhand. As the marked section of each sweeprope, located about five fathoms from the wing bridles, is hauled aboard they are removed from the blocks and fairleads and

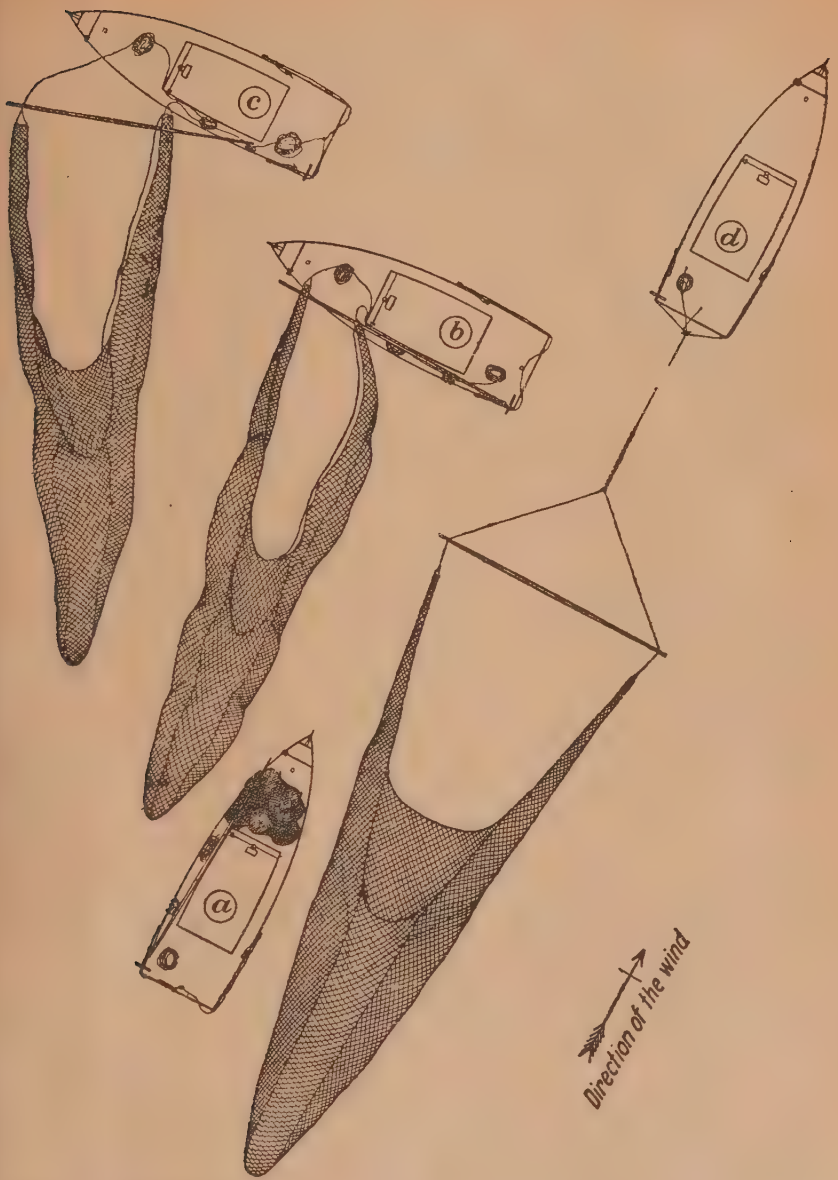


FIG. 18. The shooting operation of an utase trawl gears, diagrammatic (Umali, 1932).

secured on the after bitts. If the screw is "clear" the vessel is given a moderate speed ahead in order to "surface" the net. Then the vessel is stopped and hauling of the net resumes. Each quarter rope is tucked in on the blocks and fairleaded to

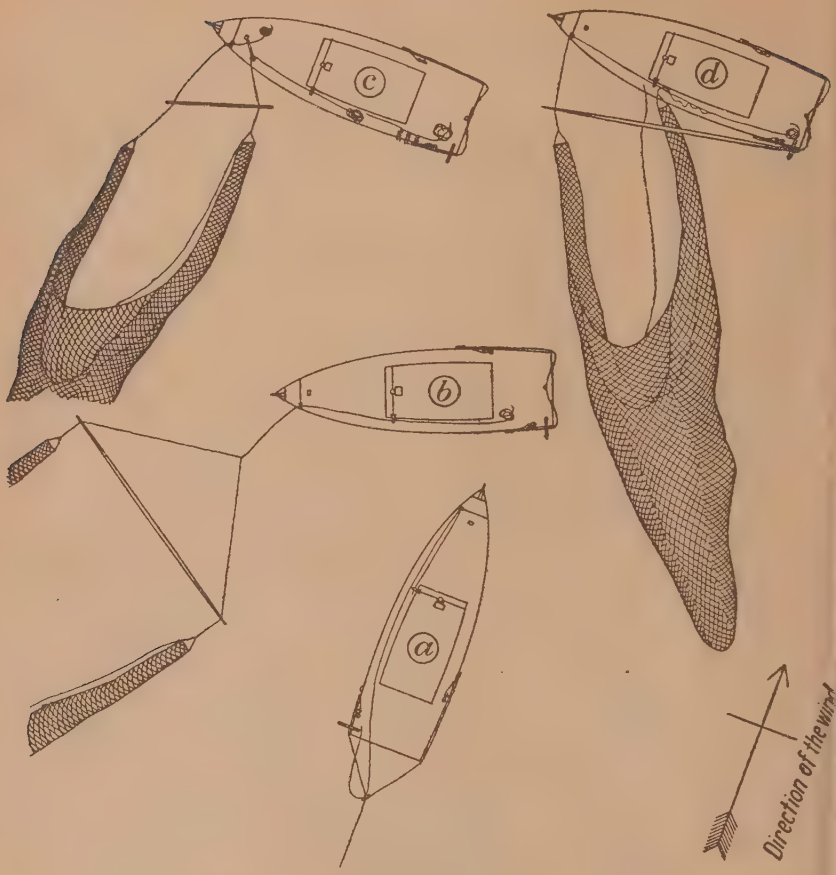


FIG. 19. The hauling process; diagrammatic (Umali, 1932).

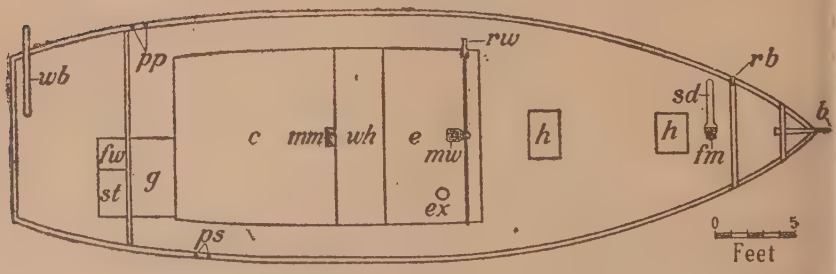


FIG. 20. A typical Japanese beam trawler, *utase*, deck plan; *b*, bowsprit; *c*, cabin; *e*, engine room; *ex*, exhaust; *fw*, fresh-water tank; *g*, galley; *h*, hatch cover; *mm*, main mast; *mw*, motor winch; *pp*, wooden pins on the port side; *ps*, wooden pins on the starboard sides; *rb*, roller, toward bow; *rw*, roller of winch; *sd*, small derrick; *st*, store box for provisions; *wb*, wooden bar; *wh*, wheelhouse (Umali, 1932).

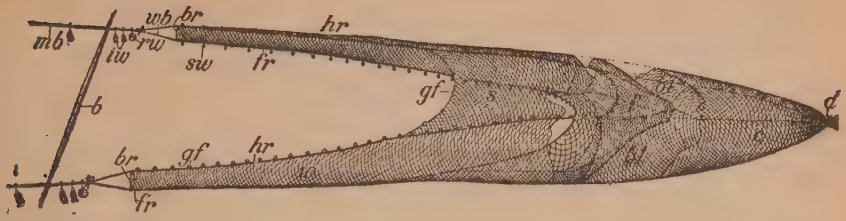


FIG. 21. Perspective view of an utase trawl net showing important parts: *b*, beam; *bl*, belly; *br*, brail; *bt*, bating; *c*, cod end or bag; *d*, draw string, or poke line; *f*, funnel-like affairs; *fr*, foot rope; *gf*, glass floats; *hr*, head rope; *iw*, iron-chain weights; *mb*, main bridle; *rw*, rock weight; *s*, square, *sw*, stone weights; *w*, wing; *wb*, wing bridle, (Umali, 1932).

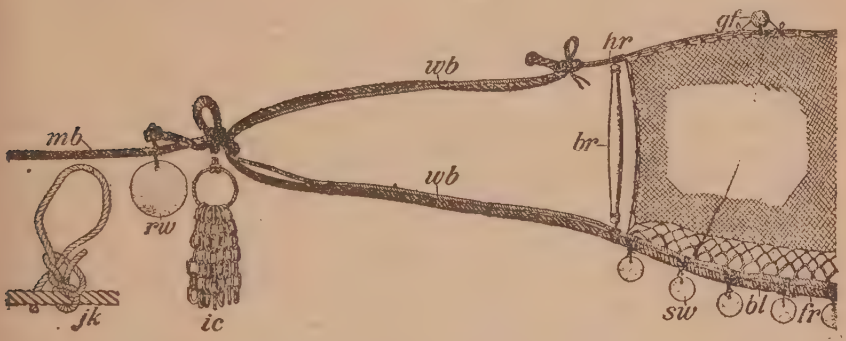


FIG. 22. An utase trawl net; end of one wing, showing various parts and accessories and its attachment to wing and main bridles; *bl*, balk line; *br*, brail; *fr*, *foot* rope; *gf*, glass float; *hr*, head rope; *ic*, iron-chain weights; *ik*, Japanese knot; *mb*, main bridle; *rw*, rock weights; *sw*, stone weight; *wb*, wing birdle (Umali, 1932).

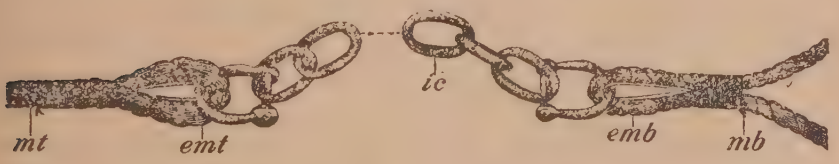


FIG. 23. A portion of an utase trawl warp, showing connection of main towline, iron chains, and main bridle; *emb*, eye-splice and thimble of amin towline; *ic*, iron chain; *mb*, bridle; *mt*, main towline (Umali, 1932).

the winch rollers. Originally, before shooting the net each quarter rope is secured by a "Japanese knot" at three to four points along the footrope. The end of the quarter rope is tied near the junction of the wing and the bosom of the net. With the aid of these quarter ropes the hauling and landing of the net is facilitated. Small nets do not use quarter ropes as they are light enough to haul in aboard the vessel even without the aid of the winch rollers or any mechanical device.

Japanese beam trawl operation.—The mode of operation of the Japanese beam trawl gear has not changed much since its use on powered vessels. The mode of rigging, shooting, hauling, brailing and sorting are practically the same as when they were operated by the Japanese fishermen before the war (figs. 18 to 19). The fishing operation is completely described by Umali (1932). There has been, however, some modifications on the original forward deck to the aft deck operations of beam trawl in the Western type of vessels. In either case, the shooting and hauling-in of the trawl net can be done on port or starboard side although, as a rule, most operations are done on the starboard side of the vessel.

Landing and brailing.—Most Philippine otter trawlers land the net and brail the catch directly over the stern. As the intermediate part (pre-cod end) of the bag is hauled aboard, the brailing frame or platform is lowered over the stern. The tail and buoy line is retrieved and the cod end hauled in. The inverted cod end is opened and its rims secured around a U-shaped, collapsible frame preparatory to brailing. Here the catch is brailed with the use of a 16-inch diameter scoop net (*panalok*). Brailing is done by two men—one holding the handle and another handling the lifting and tilting line.

Frequency, speed and duration of drag.—A drag covers the period from the time towing commences until the time of hauling the net. The normal drag of a commercial otter trawler usually takes from 2 to 3 hours, depending upon the nature of the bottom and the abundance of fish. In Manila Bay a trawler usually makes a day's trip in about 24 hours out from port. The usual speed of dragging of an otter trawler ranges from 1½ to 2½ miles per hour. This rate is approximately twice the speed of the Japanese beam trawler (*utase*). As the bag gets filled with fish the speed of the vessel slackens, hence more power is applied to maintain an optimum towing speed of about 2 miles for the otter trawler and 1½ miles for the beam trawler.

Experience seemed to indicate that the shorter and more frequent drags of from 1 to 2 hours were found more advantageous than prolonged drags of 3 to 4 hours as the former method facilitates determination of concentrations of bottom fish. Likewise, the danger of losing a portion or whole of a good drag due to some unforeseen tear can be minimized through a more frequent hauling in and check-up of the condition of the net.

Trawl warp-depth ratio.—The trawl warp-depth ratio seems to vary with the weight of the doors and the depth of the water. For example, within 100-fathom trawling off the West Coast of the United States, with the use of medium heavy doors (400 to 600 lbs. each) the ratio used is roughly three times the depth of the water being fished. In the local commercial otter trawl fishery where the doors used are relatively lighter (100 to 250 lbs. each) the trawl warp-depth ratio varies from four to six times the depth of the water. In shallow water trawling up to 10 fathoms, the ratio is increased to even ten times the depth. In deep-water trawling (100–250 fathoms) off Eureka (Scofield, 1948), the ratio is frequently reduced to somewhat less than three to one, usually two to one.

ACCESSORY GEAR

Bag line (*ayuda sa supot*).—This is analogous to the old *choo-choo* line used in the Italian paranzella nets of San Francisco, California. It consists of a single ⅝-inch diameter abaca rope instead of four pieces and it measures about 40 feet long. In operation its forward end is secured at about the midpoint of the headrope and the hind end at the tip of the cod end. It aids in hauling the bag alongside or sternside in preparation for brailing, lifting, or strapping.

Chafing gear.—This is an important accessory gear which provides protection against the rapid wear and tear of the cod end. The "mestizo" trawl nets use false bellies of fairly heavy abaca webbing which serves both the purpose of chafing gear and protection from predatory sharks. Other operators use old webbing of the bag which is attached along the rubbing side part of the cod end. Trawlers in the West and East coasts of the United States use cow hide or frayed out yarn of old ropes lined along the rubbing side of the cod end for chafing gear.

Footrope proper (*lawayan*).—Unlike the Western nets the Philippine otter trawl net uses a separate footrope which is evidently an adaptation of the Japanese utase net. The length of the footrope varies from 70 to 150 feet depending upon the size of the net. It consists of two Manila ropes; an outer (footrope) 1¼-inch diameter and an inner balk line ⅝-inch diameter rope (figs. 23 and 24). The footrope and balk lines are seized together at definite intervals of about two feet at the wings and a foot at the center or "bosom". Along the balk

line a 1/4-inch diameter "fishing line" is laced through the strand at half a foot interval. In operation the net is hung on the footrope proper by lacing together the fishing line and the outer marginal line of the net proper. It has been a common practice to use old warps for making the footrope proper. This is advantageous because in case of a snag the ropes readily break off, thereby avoiding the risk of losing the entire net. This type of elaborate footrope proper, according to experienced trawler, is suited to soft muddy bottoms at it does not readily "dig in" and if it does, the mud and other debris pass very readily through the wide meshes between the net and footrope. Lately this elaborate footrope has been entirely replaced by a single footrope directly rigged to and as part of the net proper.

Guide rope (*guia sa remorke*).—These are of two pieces, one on each side of the after bitts, each measuring about five fathoms long and 5/8-inch diameter abaca ropes. One end is secured on the after bitts and the other end is loop over the trawl warp. In operation a starboard turn of the vessel, for example, will require the slackening of the starboard guide rope and hauling in of the portside one. The guide ropes serve a double purpose of minimizing the fouling of the warps with the screw while turning as well as facilitating the retrieving of the two ropes during hauling operation.

Haulback line (*ayuda sa paresukat*).—These consist of two short lines about 12 feet long each and 5/8-inch diameter. The after-end is attached to the board end of the sweeprope and the forward end clove-hitched to the swivel of the same board. In effect each haulback line suggests the forerunner of the safety pennant of the V–D trawl and improved N–E trawl gear connections. It is used here for retrieving the sweeprope hauling operation.

Quarter ropes (*ayuda sa lawayan*).—These consist of paired ropes, one on each side of the lower part of the net. They appear to be analogous to the quarter ropes of the modern side-set trawls of the Atlantic Seaboard, but their mode of attachment and hauling connections are entirely peculiar to the Philippine otter trawl gear. Each quarter rope measures from 3/4 to 1-inch diameter Manila rope and ranges in length from 10 to 15 fathoms, depending upon the size of the net. The after-end of each quarter rope is secured at several points, one at the junction of the bosom and wing and at one or two

points along the footropes. The forward end, which is more or less free, are secured by half hitches along the net-end of the sweeprope. In operation it (quarter rope) is unwound during hauling as the footrope comes up on the fair-leading blocks. In subsequent shooting of the net, this is secured again at marked points with a pair of short pennants on the footrope. As there is usually no boom or mast used to assist in lifting on most reconverted utase vessels, this arrangement facilitates a "straight after deck" hauling aboard of the net.

Snag line (*panabit*).—This is apparently a new accessory gear recently introduced in the commercial otter trawl fishery and is only used when operating in new areas where underwater obstructions are likely to be encountered. It consists of either a flexible cable wire of ½-inch diameter or a ¾-inch diameter Manila rope. When Manila rope is used it is "leaded" with chain, lead or rock weights. During operation each end is attached with a snap swivel at the bottom aft-corner of each board or at the swivel "focal center" of the otter door. In effect it resembles the ticklers of the Western shrimp trawl nets. There are, however, some pros and cons with regard to its effect on fishing efficiency. While it may scare the fish along its path during fishing, as claimed by one school of thought, this minor disturbance cannot possibly compensate for the risk of losing, or tearing off the gear. The stirring action by the snag line seems to increase the catch of flatfishes and shrimps. This question has not been scientifically ascertained although it has been demonstrated satisfactorily as a necessary accessory gear especially in commercial exploration of new grounds.

Sounding lead.—This is the traditional equipment used in determining the depth and type of bottom. The common sounding lead used in the commercial trawl fishery consists of a five-pound hexagonally-shaped lead, provided with a cavity at its base for securing sample of the bottom. A 50-fathom sounding line made of 90-thread hardlaid cotton twine is used and this is marked at five fathom interval. In the trawl fishery of England, Europe, and America today, the sounding lead has practically been replaced by the modern fathometers. This echo-sounding device has increased fishing efficiency and minimized the losses on gear. Of late there has been installed in these modern draggers, radio telephone, range finders and radar which have placed fishing on a more scientific basis.

Sweepropes.—The sweepropes consist of a pair of ¾-inch to 1¼-inch diameter abaca ropes which varies in length of from 15 to 35 fathoms, depending upon the power of the vessel. The sweepropes arrangement consists of a forward attachment to the door straps and an aft connection to each wing bridle. The connections simply include an eye splice—thimble and shackle connections between the net and the doors. One or two otter trawlers have already adopted the improved New England bridle arrangement which consists of long leaders of flexible cable wire connected by V–D [4] links (fig. 25). This system is very handy with cable wires which are mechanically operated with regular drum winches.

Tail and buoy line (*buya sa supot*).—This is used as a precautionary measure in case of accidental parting off the warps due to underwater snag or obstruction. With this buoy line the net may be retrieved. This line which is about the same size as the bag line varies in length from 15 to 20 fathoms depending upon the depth of water. This is an important accessory gear especially in exploring new areas and those with many underwater snags.

The wing brails or "Dhanlenos" (*baras*).—The pair of wing brails is still a common feature of the Philippine commercial otter trawl gear. Each brail is attached to the forewing of the net. The brail holds and spread the forewing in an upright position during the fishing operation. It consists of a piece of elongated wood measuring about 2.5 inches in diameter and about 3 to 4 feet long. These wing brails, according to underwater tests conducted by New England engineers, prevent the net to balloon freely (Symonds and Towbridge, 1947). In the same experiment, when the wing brails were removed and the wing bridles extended into long leaders, the height of the headrope of the net was considerably increased, thereby catching both the bottom and intermediate group of species which, heretofore, have not been effectively taken.

CARE AND HANDLING OF CATCH ABOARD THE VESSEL

Sorting (*pamimili*).—The sorting and classifying of trawl-caught fish which are done manually are the most tedious and

[4] V–D is merely an improved method of connection of the otter trawl net to the otter door by providing a ground cable (sweeprope), thereby increasing the effective fishing swath of the net. Invented by two Frenchmen—Vigneron and Dahl—in 1925 this was then known as V–D system.

time-consuming phase of the fishing operation because the catch consists of a heterogenous mass of many varied and relatively small species of fish. From 60 to 80 per cent of the catch is below the 6-inch size and very few exceed the 12-inch size. The sorting of the catch is one of the main stumbling blocks in the reduction of crew in trawl fishing vessels as there is, so far, no mechanical sorter yet devised for the industry. Fast and efficient sorting is absolutely necessary in order to minimize the rapid spoilage of fish while awaiting storage in the hold. The rate of sorting depends upon the efficiency of the sorters and the amount of catch landed. A normal haul of 1 to 2 hundred kilograms can be sorted in one hour by one or two experienced fisherman sorter.

The catch is usually sorted and generally classified into five or six commercial groups, not necessarily species. This commercial classification as named in the order of their market values are:

Local name	English name	Remarks
Hipon and pusit..	Shrimp and squid	Undersized of all classes, and species.
Joya	Large species	From 6″ and up first and second class).[a]
Halo	Mixed medium species	Three inches to 5 inches of first and second class.
Sapsap	Big slipmouths	Two to 4 inches.
Samot	Miscellany	Six inches up or third class fish.
Dyako	Fish trash	Further classified as to size mostly slipmouths.

[a] Total length of fish.

Sorting equipment.—Sorting is done manually and the work is facilitated with the use of the following equipment: hand gaffs or hooks (*gancho*), wooden rakes (*pañgahig*), sorting stools (*bangko*), flat-end shovels (*pala*), flat baskets (*bistay*), and cylindrical baskets (*canastro*).

Sorting and classifying are done in between drags. The sorters work around the pile of fish. With a wooden rake (pañgahig), a sorter rakes a small pile of fish towards him and start working on it. The two hands work independently, picking every fish as it comes along and throwing each fish to its respective basket containers (bistay). All trash and debris are thrown overboard. After sorting, the catch is

thoroughly washed with seawater to remove all slime and dirt. Then the catch is either arranged in tray, stored in fish bins, or packed in 100-kilo boxes or galvanized iron cans (banyera).

Traying (pagkakaha).—Traying is usually done by Manila Bay and Lingayen trawlers where the catches are comparatively less. It consists of properly arranging the commercially classified fish in standard bamboo or wooden boxes locally called tray (*caja*). Each tray measures 24″ x 12″ x 3″ and the net weight is about 4 kilos (10 lbs.). Traying is considered an art and the trayed fish should look appealing to the buyer. An attractively and properly trayed fish often commands a relatively better price than one that is messy in arrangement. For this reason the traying of the more expensive commercial group, such as shrimp, squid, large and medium-sized species, is done by an experienced man, usually the master or the second master fisherman. The less expensive groups are trayed by the regular deck hands. The trays of fish as classified are properly recorded by the skipper who makes the report to the owner at the fish landing. The trayed fish are then ready for icing and storing in the fishhold.

Icing and storing.—Manila Bay trawlers ice their catch differently from outside trawlers. In Manila Bay the fish are classified and arranged in trays and a layer of crushed ice is spread on top of the fish. Then the trays containing ice and fish are arranged in tiers in the fishhold. Everyday fresh layer of crushed ice is spread over the fish. In order to minimize the fast thawing of the top ice a piece of canvas or gunny sack, is often placed over the tiers of fish trays.

The outside trawler, on the other hand, ice and pack the catch in fish bins in alternating layers of crushed ice and fish. Each classified group of fish is packed in separate bins or compartments. A separate flooring is used for every 12- to 14-inch layer of iced fish in order to avoid undue crushing by the upper layers. In packing the usual proportion of ice to fish are as follows:

Length of trip	Proportion of ice to fish by bulk
One week	One to one.
Two weeks	Two to one.
Three weeks	Three to one.

In the latter part of 1950 the trawl and the basnig operators introduced the use of the *banyera* system in storing and handling the catch aboard the vessel. The more expensive

species, like the shrimps and the bigger species (joya), are packed in alternate layers of ice and fish in elliptic-shaped or rounded galvanized iron containers. These are arranged in tiers in the hold and for every layer a board flooring is used to hold the succeeding layers. According to these operators this new system results in a much better quality of the catch, besides minimizing the handling of the iced fish from sorting to unloading. A banyera contains about 40 kilos of iced fish.

Normally, under Philippine conditions, properly iced fish can be kept in fairly fresh condition within a period of from 10 to 15 days without the aid of mechanical refrigeration.

THE CATCH

Species taken.—The species taken by commercial otter trawler in the Philippines consist of a wide variety of aquatic animals which generally inhabit the smooth sea bottoms.

The following is a list of marketable species comprising the bulk of the commercial trawl catches in Manila Bay which, in general composition, is typical of any trawling ground in the Philippines.

Frequency of occurrence	English	Tagalog	Scientific name
Abundant ..	Slipmouths	Sapsap	*Leiognathus bindus*
			L. splendus
			L. equalus
			Gazza minuta
	Lizard fish	Kalaso	*Saurida tumbil*
	Mojarras	Malakapas	*Gerres punctatus*
	Nemipterid	Bisugo	*Nemipterus japonicus*
			N. taeniopterus
	Goatfishes	Saramullete	*Upeneoides sulphureus*
Common	Shrimps	Hipon	*Penaeus* spp.
	Pomadasids	Bakoko	*Pomadasys hasta*
	Pomadasids	Bañgokñgok	*P. argyreus*
	Cavallas	Talakitok	*Caranx* sp.
	Crevalle	Salaysalay	*C. leptolepis*
	Grunts	Babansi	*Therapon* spp.
	Croakers	Alakaak	*Johnius aneus*
	Gray shark	Pating	*Scoliodon walbeehmii*
	Barracuda	Torsillo	*Sphyraena obtusata*
	Turbots	Kalankao	*Psettodes erumei*
	Snappers	Bambañgin	*Lutjanus fulvus*
	Catfishes	Kandule	*Arius* spp.
	Cutlass fish	Balila	*Trichiurus* spp.
	Whiting	Asohos	*Sillago sihama*
	Lactaridæ	Pellan	*Lactarius lactarius*

Frequency of occurrence	English	Tagalog	Scientific name
Common	Gizzard shad	Kabasi	*Anodontostoma chacunda*
	Drepane	Mayang	*Drepane punctata.*
	Flathead	Sunog	*Playtycephalus* spp.
	Squids	Pusit	*Loligo* sp.
	Crabs	Alimasag	*Neptunus pelagicus*
	Soles	Dapang bilog	Bothidae.
	Brills	Dapang chinelas	Soleidae.
Occasional..	Cardinal fish	Langaray	*Ambassis* spp.
	Anchovies	Dilis	*Stolephorus* spp.
	Mackerel	Hasahasa	*Rastrelliger brachysomus.*
	Spanish mackerel	Tanigue	*Cybium commerson.*
	Herrings	Lapad	*Sardinella* spp.
	Barracuda	Torsillo	*Sphyraena jello.*
	Dorab	Parangparang	*Chirocentrus dorab.*
	Grouper	Lapo-lapo	*Epinephelus* spp.
	Moonfish	Chabita	*Mene maculata.*
	Pike eels	Pindanga	*Muraenesox cinereus.*
	Pomfrets	Duhay	*Stromateus niger.*
	Sawfish	Tagan	*Pristis microdon*
	Sergeant fish	Gele	*Rachycentron canadium.*
	Sting rays	Pagi	*Dasyatis* spp.
	Cow-nosed rays	Palimanok	*Rhinoptera javanica.*

Size of catch.—The size of the catch varies with the area and possibly the season of operation. A small otter trawler operating in Manila Bay (1950) averaged between 50 to 100 trays (200 to 400 kgms.) a day, while medium trawlers operating outside, in the trawling grounds of southwestern Samar, used to average from 10 to 12 tons (10,000 to 12,000 kilos) per trip of 10 to 15 days. A 15-ton fare in a 10-day trip outside is considered a very successful one. Outside trawlers can usually make five trips in two months. As a gauge to relative abundance of bottom fish the rate of catch per hour or per day is of greatest importance.

While there are no adequate statistics to show the effect of season on the size of the catch of otter trawls, it seemed that the better catches are usually taken in areas less exposed to the prevailing monsoons and those influence by effluent washings from rivers and water-shed areas. For example, Manila Bay and Lingayen Gulf are relatively productive during the rainy season but quite poor during the dry season. South-

western Samar is more productive during the northeast monsoon period (November to March) than during the other periods of the year. In other areas, such as Tayabas Bay, San Miguel Bay, Sorsogon Bay, and Sisiran Bay, however, the presence of abundant jelly fishes during the dry months (April to June) negatively affects the size of catches.

The following catch data were furnished by fishing captains and master-fishermen of commercial trawlers operating in various trawling grounds in the Philippines (June 1950).

Areas	Rate of catch of marketable fish in kilograms per normal drag of 3–4 hours
Lingayen Gulf	60–120
Pilar Bay	200–400
Southwestern Samar	300–500
San Miguel Bay	350–600
Off Estancia	250–400
Guimaras Strait	400–700
Masbate	200–400
Ragay Gulf	150–350
Manila Bay approaches	100–200
Tayabas Bay	200–300

Comparative catch of otter trawl and utase.—For purposes of comparative study, the rate and the percentage composition of the catch, by species, of the commercial otter trawl and utase operating in Manila Bay were undertaken in order to determine the decided advantage and superiority of the former over the latter. Since the introduction of the otter trawl there has been some doubts in this direction especially among the diehard utase operators.

In this observation the average monthly catch of fourteen otter and forty-four utase trawlers operating in Manila Bay from December, 1948 to May, 1949 was taken for general comparison (Tables 11 and 12). It will be seen that the rate of catch per hour for all months combined was 33.9 kilograms (84 lbs.) for the utase and 45.8 kilograms (100 lbs.) for the otter trawl during the same period of operation. The difference of 11.9 kilos (26.2 pounds) in the rate of catch of the otter trawl may not appear significant in favor of preference to it as an improved gear. But let us analyze the economics of operation during the period of observation (Table 9). It will be noted that on the average the daily operating cost of an utase trawler was estimated to be about 50 pesos more than that of the average otter trawler. This is due to the

TABLE 11.—*Average catch composition of forty-four commercial beam trawlers operating in Manila Bay (1948–1949).*[a]

Date	Fishing time	Shrimps	Squids	Large species (Joya)	Medium species (Halo)	Slip-mouths (Sapsap)	Miscella-neous (Samot)	Fish trash (Jaco)	Total	Rate of catch
	Hrs.	*Kgms.*	*Kgms.*	*Kgms.*	*Kgms.*	*Kgms.*	*Kgms.*	*Kgms.*	*Kgms.*	*Kgms.*
December, 1948	120	454	88	855	576	560	492	1,396	4,221	35.17
January, 1949	560	1,188	336	3,756	3,032	3,458	2,408	4,310	18,578	33.17
February, 1949	336	670	176	2,712	2,154	2,674	1,944	2,090	22,510	37.23
March, 1949	388	884	226	3,766	2,514	2,402	2,070	2,058	13,920	35.87
April, 1949	352	756	220	3,016	1,700	1,716	1,746	1,160	10,314	29.30
May, 1949	428	1,088	274	4,290	2,233	1,920	2,602	1,639	14,046	32.81
Total	2,184	1,320	18,395	12,009	12,910	11,262	11,262	12,653	73,589	33.92
Per cent		6.8	1.7	24.9	16.3	17.5	15.8	17.0	100	

[a] Actual catch data collected by Alejandro Erasga, fish checker, Philippine Bureau of Fisheries.

TABLE 12.—*Average catch composition of fourteen commercial otter trawlers operating in Manila Bay (1948–1949).*[a]

Date	Fishing time	Shrimps	Squids	Large species (Joya)	Medium species (Halo)	Slip-mouths (Sapsap)	Miscella-neous (Samot)	Fish trash	Total	Rate of catch per hour
	Hrs.	*Kgm.*	*Kgm.*	*Kgm.*	*Kgm.*	*Kgm.*	*Kgm.*	*Kgm.*	*Kgm.*	*Kgm.*
December, 1948	7	4	8	48	64	116	12	88	340	48.57
January, 1949	115	208	60	820	428	732	756	924	3,928	34.15
February, 1949	95	176	96	1,128	848	1,220	632	892	4,992	52.54
March, 1949	105	422	60	1,456	876	880	832	834	5,360	51.04
April, 1949	107	260	72	1,198	662	628	806	792	4,418	41.28
May, 1949	102	300	68	1,646	852	564	682	660	4,772	46.72
Total	531	1,370	364	6,296	3,730	4,140	3,720	4,190	23,810	45.85
Per cent		5.75	1.53	26.45	15.67	17.38	15.63	17.59	100	

[a] Actual catch data collected by Alejandro Erasga, fish checker, Philippine Bureau of Fisheries.

fact that the number of crews employed, size of net, size of boat and horsepower of the engine on the present utase trawler are more preponderant than those of the otter trawlers. Another point that should also be considered is that the otter trawl is of recent developments. After only barely two or three years of adoption by the commercial fishery its fishing efficiency and techniques have not been so developed yet as the old utase which has been in local use for almost half a century. There is evidently plenty of room for the improvement of the otter trawl gear and increasing its crew's fishing efficiency.

There are also some divergent opinions as to the relative composition of the catch of the two types of trawl used in the present commercial fishery. It has been the persistent claim among utase trawl operators that the otter trawl gear catch less shrimp than the utase. From the observations taken from December, 1948 to May, 1949, it will be seen that the percentage composition did not vary very significantly. On the overall catch landings the utase landed only one per cent more of shrimps and about 2 per cent less of the large species (joya) as compared with the otter trawl landings during the same period. This difference is apparently not very significant even from the point of commercial value. This slight difference may be attributed to the fact that the commercial otter trawl uses a coarser and consequently more selective net than that of the utase trawler. The former employs a cod-end with a mesh of 3.0 to 4.0 cm. stretched, compared with the 2.5 to 3.0 cm. of the latter. Moreover, the preponderance on the percentage of the larger species by the otter trawler may be accounted for by the relatively faster rate of dragging, 1½ to 2 miles per hour. The much heavier leaded footrope and the slow-dragging speed of the utase trawler were apparently advantageous in catching slightly more shrimps as the net makes better "scrape" at the mud bottom. Shrimps, by nature, burrow in the bottom with only the eyes and the antennae out of the mud.

More shrimps could have been taken by the otter trawlers if they have operated in the same shrimp area and at the same time. But during the period of observation the majority of the utase trawlers concentrated their operation between the 25- and 35-meter line and these areas appeared to be natural shrimp grounds in Manila Bay. As a general practice the utase trawlers start "shrimping" in these areas from sundown to sunrise which, from our experience, appeared to be the best

time for catching them. The otter trawlers generally operate along the shallow sheltered areas of the Bay (Pampanga Bay) which normally harbors plenty of the estuarine species. Shrimps are, however, few in these areas.

MARKETING THE CATCH

The Navotas Fish Landing.—Off Barrio Bankulasi, Navotas, Rizal, are located the main fish landing and the Central Fish Exchange of most trawlers and other commercial fishing boats operating in Manila Bay and vicinities. It is presently accessible from the cosmopolitan area of Manila via the 10-kilometer Malabon–Navotas road and is about 5 kilometers by water from the mouth of Pasig River. It is about 4 kilometers from the heart of the city via the North Bay Boulevard which is under repair at the present writing.

The fish landing of the trawlers is actually an unsheltered anchorage without any fish pier nor breakwater for protection during inclement weather. Fishing boats simply drop anchor off shore along the 4-meter line, about a few hundred meters from the fish exchange establishment. This fish anchorage is tenable during almost the whole year round except in July and August when it is exposed to the prevailing southwest wind. During heavy swells unloading of the fish and ferrying of supplies from ship-to-shore or vice versa becomes almost impossible. The fishing boats then seek for any convenient place along the North Harbor piers or along the Pasig River or enter the Navotas–Malabon River. The landed fish are taken back to the central fish exchange at Navotas by trucks, passing the same marketing route taken by wholesalers to Manila markets.

The business transaction at the Navotas fish landing may be described as follows: The Manila Bay trawlers start to come in at 3:00 o'clock in the morning but majority of them arrive at 4:00 o'clock just in time for the busiest part of the fish market activities. Out in the bay during good weather the trawlers are conveniently guided to the fish landing by a fixed green and red light set on a 20-meter pole at the landing. Between 3:00 and 4:00 o'clock in the morning the hustles of jeeps, trucks, DUKWs [5] and bancas along the shore line of the fish market become distinctly audible. Each DUKW or banca watches for the signal of its vessel as she comes in from the Bay. The signal may vary from a series of flashing

[5] Amphibian trucks secured from the U. S. Army surplus.

light or a display of a combination of colored lights on the mast. As the trawlers come in they anchor and the catch is unloaded to waiting DUKWs or bancas which tie alongside. One DUKW can "service" as many as four trawlers for it can load as much as 400 trays of fish. The trayed fish are hauled ashore and delivered to the commission agent where they are checked as to number and kind. The fish are then ready for auctioning.

The Central Fish Exchange.—The Central Fish Exchange or the Boulevard Wholesale Fish Market is located along the same sandy beach of the fish landing at Navotas, Rizal. The market consists of a long shed of semipermanent materials which is open toward the shore and closed toward the roadside save for a few alleys and entrances to the bidding place. Each lot, which measures about 50 square meters, is rented by the commission agent on a monthly basis from a certain private individual who owns the entire lot. The shed is constructed by the individual commission agent, who provide their own light facilities, storage for supplies, and necessary tables for clerks and a few chairs or benches. The adding machine is a common office accessory of the clerk-accountant of the commission agent. The personnel of a typical commission agent serving from one to three trawlers usually consist of two auctioners, one clerk-accountant, and two or three helpers.

The commission agent (*tendera*), who is usually not bonded at all, takes charge of the disposal of the fish by public auction. All bidding is done secretly by the "whispering system" and, as a rule, the highest bidder gets the commodity. The system of bidding is quite unique and interesting. The bidders whisper in succession until the highest bid is obtained by the agent. If the highest bid does not suit the agent he calls for another bid. In case of a tie in bidding and there is no move on the part of the bidders to raise the bid, the two or three successful bidders divide the fish lot equally among themselves. The winning bid is always announced for the satisfaction of the other bidders.

All fish transactions at the fish market, which are mostly wholesale, are based on the "good faith "system. The transactions are made without the usual sales invoice slip as required in organized business. Each buyer is given a period of 24-hour grace to pay back his account the previous day. Bad debts are seldom encountered. Wholesale buyers of fish from commission

agents are neither bonded nor under obligation to bid for fish under one commission agent. One can bid from one commission agent to another provided he settles his account regularly to his agent. Default from regular payment debars one to participate in subsequent biddings until his account is satisfactorily settled.

Generally, the auctioning hour starts as early as 3:00 o'clock in the morning when the catch of the first trawl is usually landed and auctioners are already available to start the bidding. Auctioning goes on as the fish are landed until about 5:00 o'clock in the morning. From 5:00 to 7:00 o'clock in the morning the catch of the *basnig, sapiao, talakop, baklad* and handliners and other gear is landed and auctioned in the same manner as the catch of the trawlers.

For disposing the operators' catch the commission agent gets from 4 to 5 per cent of the gross sales. After the marketing hour the agent pays in cash the sales value of the day's catch to the vessel operator or owner. In addition to this service of the commission agent the boat owner gets free use of baskets, collection of fish trays, and more often, emergency cash for boat repairs and boat operation. In other words, the commission agent, in many instances, also serves the role of the banker of many fishing boat operators.

After the day's fish auctioning, which usually closes at about 7:00 o'clock in the morning, DUKWs, bancas, fuel barges and ice trucks start the rounds of servicing the boats of needed supplies. One or two diesel fuel floating barges service the sixty to eighty fishing boats landing daily at the Navotas Fish Landing. About twenty to thirty DUKWs and a good number of fast-service dugouts operate daily at the landing. At about 8:00 o'clock in the morning the trawlers start to leave for the fishing ground in the Bay.

The following are the daily fixed charges to a trawler at the Fish Landing:

Service	Rate
1. Commission agent	4 to 5 per cent of gross sales
2. DUKW service	₱10.00 a day
3. Banquero service	₱5.00 a day
4. Landing fee (municipal tax)	₱1.00 a day

Fish disposal.—In Manila the catch of the trawlers is disposed of in the (1) fresh fish markets, (2) fish-drying establishments, and (3) bagoong industry. The entire catch of

trawlers operating in Manila Bay is marketed in the fresh state, except the fish trash (*dyako*) which is ground and made into bagoong. This kind of bagoong, it is said, finds a good market in the interior towns of Northern Luzon.

The catch of outside trawlers, however, is disposed of in the fresh fish markets of Manila and fish-drying establishments in Tondo and Navotas. As a rule the outside trawlers do not bring in fish trash (dyako). In the fishing grounds whatever trash is caught is given away to hired fish sorters or helpers or thrown overboard. The slipmouths, which usually form 40 to 50 per cent of the trawl catch outside Manila Bay, are usually disposed of to the fish-drying establishments, and the rest of the bigger species and shrimps are sold in the fresh fish markets together with the catch of the Manila Bay trawlers. The price of the catch of the trawlers operating outside is about 20 to 30 per cent lower than the same kind of fish caught in Manila Bay because of the great difference in quality brought about by prolonged storage of the fish in the former.

The landings of trawl-caught fish at the Navotas Fish Exchange is estimated to be 15 to 20 tons daily. Added to this is about the same amount of the combined catches of basnig, sapiao, fish traps, and handliners operating in Manila Bay and its approaches. Price situation in this relatively small amount of fresh fish handled daily is quite sensitive. Occasional landings of from 15 to 20 tons of mackerel (*hasahasa*) taken by native purse seines (*talakop*) and fish corrals from Malampaya Sound and Manila Bay immediately upset the prices. This is due to lack of organized marketing and distributing system in the handling of fresh fish in the Manila area and surrounding provinces.

The current (1950) wholesale prices in Manila of the different commercial groups of fish taken by trawl are as follows:

English name	Tagalog name	Price per tray of 10 lbs. *Pesos*
Shrimps:	**Hipon:**	
Jumbo size	Sugpo	12–14
Medium size (white)	Puti	10–12
Medium size	Suaje	10–12
Small size	Quakit	7– 8
Squids	Pusit	10–12
Bigger species (Joya):		
Groupers	Loba or lapulapu	14–16
Snappers	Bambangin	8–10

English name	Tagalog name	Price per tray of 10 lbs. *Pesos*
Nemipterids	Bisugo	7– 8
Bothids	Kalankao	6– 8
Barracuda	Torcillo	6– 8
Crevalies	Salaysalay	5– 6
Drepanids	Mayang	4– 5
Mixed medium species (Halo)		3– 4
Slipmouths	Sapsap	1– 2
Miscellany	Samot	2– 2.50
Swimming crabs	Alimasag	2– 4
Lizard fish	Kalaso	2– 3
Gizzard shad	Kabasi	4– 5
Fish trash	Dyako	[a]2– 4

[a] Per basket of 25 kilograms each.

CARE AND MAINTENANCE OF FISHING GEAR AND ACCESSORIES

The unusually rapid organic and bacterial activity in the tropics brought about by relatively high temperatures and strong sunlight are contributory factors in the rapid deterioration of fishing gear and accessories. Deterioration may be brought about through physical wear and tear and consequent weakening of organic fibers of nets and ropes due to action of bacteria, mold and other organisms. Enzyme action brought about by fish slime and dead fish works hard especially on the fish nets. Teredos and other marine growths are likewise very active in tropical waters affecting wooden hulls of fishing vessels in varying degrees of exposure in the water. Flexible cable wires also wear out rapidly owing to action of rust (oxidation through exposure to air and action of salt water). Gear depreciation in the trawl industry is estimated to be from 100 to 150 per cent annually. This depreciation can be reduced through proper care and maintenance of the fishing gear and accessories.

Towlines.—The Manila (abaca) ropes used as towlines in trawl fishing are not treated with any kind of preservative. They are directly used as they come out of the factory. Many of the locally manufactured Manila ropes are pre-treated with oil and this keeps them quite impervious to water for some time. However, the small-stuff Manila towlines are either lightly tarred or creosoted. The normal span of life of these kinds of towlines used in the local trawl fishery is as follows:

Kind of towlines	Normal span of life *Months*
Plain Manila rope	3 to 5
Plain cable wire	12 to 24
Cable wire (parcelled with Manila rope, then tarred)	8 to 10

Initially, the use of cable wires for towline is more expensive than Manila ropes. Cable wires require, in addition, drum winches for efficient operation. But in the long run these cable wires turn to be much more economical than plain ordinary Manila (abaca) ropes.

The following are suggestions in prolonging the life span of Manila (abaca) towlines:

a. Towlines should, if possible, be spooled in a wooden drum or simply coiled on a latticed platform on the foredeck.

b. They should not be allowed to slide taut through the towing bitts or bollards. Necessary rollers should be provided for in order to reduce wear and tear of the towlines at this point.

c. The towlines should be thoroughly washed off slime and mud after every fishing trip and properly stacked to dry on the gunwale of the vessel.

d. Tanning or tarring Manila towlines may help prolong the life span of towlines.

e. All rope-end connections should be provided with the proper size of thimbles in order to prevent the rapid wear and tear of these parts.

f. Fairleads and towing blocks for Manila towlines should, if possible, be made of wood and of proper size of sheaves in order to minimize wear and tear of the strand.

Plain cable wires.—The deterioration of plain flexible wires is much faster than that of Manila ropes if not properly taken care of. They deteriorate faster especially when not in use due to the action of rust. Through use they also wear out fast with the improper use of size of sheaves and without due consideration to the proper working load requirements of specific size of cable wires.

The following are hints in the proper use of plain cable wire for towlines:

a. Plain cable wires should be regularly greased or oiled (bunker or used engine oil) after weekly fishing trips. When the vessel is tied up for repairs it is advisable to grease the

cables in order to avoid rust decay. A regular warm oil treatment prolongs the life of cables as it does not only protect the outer wires but also penetrates the hemp center, thereby preventing rust and excessive friction of the inside wires. This is an important factor in the life service of a wire rope. Biscolite or tar treatment are also recommended as it prevents the penetration of salt-water into the inner strands. This latter treatment can easily be applied with a brush and then allowed to dry before using the cables.

b. The working load of plain cable wire for general purpose should not exceed one fifth of its tested breaking strength. Factor of safety in excess of 5 varying up to 8 and even more, are often required for safety and economical operation.

c. The load should not be lifted with a jerk as the strain may equal three or four times the proper load and a sound rope may easily break.

d. Wire ropes should be examined frequently for faults or weak points. A new rope is cheaper than losing an entire gear and/or preventing accidents on board the vessel.

e. Great care should be taken so that the grooves of drums and sheaves are perfectly smooth, ample in diameter and conform to the surface of the rope. Perfect alignment of the sheaves and blocks are necessary so that the ropes may not chafe on the sides of the grooves.

Care of nets.—On board the vessel reserved nets should be properly stacked in a cool, airy place where it is not likely to get wet by the rain or the splash from sea water. If space is limited on deck, it may be stacked on top of the pilot house and then properly covered with a good water-proof tarpaulin for protection from rain and sunlight. In stacking, the nets should be property piled on a wooden latticed platform so it will not get wet from water seepage underneath. In fishing, the belly of the bag should be provided with a chafing gear in order to minimize the wear and tear of the net at this point. Old coarse cotton or abaca webbing soaked in tar makes good chafing gear.

At times dolphins and sharks prey on the gilled fish of the bag consequently tearing off circular holes and often spilling a good portion of the catch. This is minimized by covering the entire bag with false bellies made of coarse webbing.

After fishing the net should be thoroughly washed by towing it behind the vessel for at least an hour in order to remove the slime and mud. If the same net is to be used again in the

succeeding trip, the net is spread out on board the vessel for partial drying, keeping the floats and lead weights intact. In Manila Bay fishing the net is usually used continuously for three days before it is sent ashore for mending and tanning. Nets in actual use should not be carelessly piled on deck and exposed for a prolonged period under direct sunlight as heating hastens bacterial action. Similarly, nets or portions of it should not be stacked wet in the hold. These are some of the pertinent causes of rapid rotting (*buog*) of nets on board the vessel.

Tanning of nets.—Two common methods of net treatment are used in the commercial trawl fishery, namely, (1) the straight tan-bark and (2) combination blood-tan-bark method. The blood treatment is gradually being outmoded by the first method. Chemical treatment of nets with the use of tar and copper oleates is seldom, if ever, used in the preservation of trawl nets. However, creosote-tar is used for treating chafing gear, glass-buoy nets and parcelled trawl warps of beam trawl. The nets are tanned either in concrete vats, in 50-gallon drum, or in open dug-out banca.

Straight tan-bark method.—This is a universal method of net treatment also used with other kinds of commercial fishing gear in the Philippines. It consists of extracting the cultch from dried bark of either *nigue* (*Xylocarpus* spp.), *tañgal* (*Ceriops tagal*), or a combination of the two. The ratio of tan bark to fresh water solvent varies with the condition of the net. For a new net, from 10 to 20 kilos of coarsely chopped tan bark is boiled in about 50 gallons of water and from 5 to 10 kilos in the same amount of water for old nets. The mixture is boiled in an iron vat or in a 50-gallon drum from 10 to 15 hours until complete decoction is obtained. Then the net is soaked in the solution while still hot until thoroughly 'struck'. Then the net is hung out to cool under the shade overnight and dried under the sun.

The combination tan-bark and blood treatment consists of the usual tanning procedure just described followed by the blood treatments as follows: 10–15 gallons of ox blood mixed with 30 gallons of fresh water or enough water to wet one net.

The net is soaked in the blood solution until all of it is absorbed by the net. It is then steamed from 4 to 6 hours until the blood has completely coagulated which is indicated by a glossy appearance.

Experiments conducted by the U. S. Fish and Wildlife Service Rehabilitation Program in the Philippines (1948–50) and the Philippine Bureau of Fisheries on various fishing gear preservatives showed that creosote and tar are superior for trawl nets under our conditions. They are the least expensive for use either in combination with blood and/or tanning treatments. The locally established blood and tanning treatments are reported to prolong the life of heavy type of nets. This old method seems to be more expensive than the tar treatment. In the tar treatment, however, some precautionary measures should be observed in drying or storing. Such nets should be dried under the shade, as direct and prolonged sunlight rots them. In storing hang the net under the shade or if heaping is necessary, a generous quantity of table salt should be sprinkled over the layers of netting.

In a recent commercial test in the use of tar-creosote-gasoline treatment on trawl nets by the Bureau of Fisheries, it was found that the net could be used continuously for two months without any adverse effect on the net. The formula used for treating a 100-foot net is as follows:

Refined coal tar ("Atco")	gallons	10
Gasoline	pints	5
Creosote	pint	1

This treatment costs about 70 pesos including labor against about 200 pesos on the ordinary tan-bark method in two months. It avoids the use of the hot-bath treatment on tar at 200°F. to 215°F. Care should be observed in the use of the highly inflammable gasoline when adopting the cold tar-creosote treatment.

OUTLOOK OF THE TRAWL FISHERY

Despite the tropical and insular nature of the Philippine Archipelago which are characterized by a relatively limited coastal shelf and not an overly-rich ground, a trawl fishery of some magnitude has developed during the last three decades. The fleet has expanded at an alarming rate since the liberation of the Philippines in 1945, especially during 1950–51. The area of operation has so expanded in space than in depth that depletion in certain areas has become increasingly evident, particularly in Manila Bay, southwestern Samar, and the Visayan Sea.

In 1950 there were 286 trawling vessels ranging in size from 5 to 95 gross tons operating in a trawling area of about

4,600 square miles of Philippine waters. Computed on a unit space basis, one trawler is limited to only 15.7 square miles. Using a conventional 100-foot net and dragging at an average speed of one and a half miles per hour and normally fishing at 12 hours a day, an average 50-foot trawler can completely fish this unit area in about 48 days. Therefore, in a normal 200-day annual operating period per trawler, the same vessel will be forced to fish the remaining 152 days in the same unit space or in other unit areas supposed to be allocated to other vessels. This state of affairs is unavoidable on account of the limited trawling grounds with an over-expanded trawl fishery. This condition results in over-fishing and eventually lead to serious depletion of the fishery. It is doubted, even with the relatively high rate of life activity in this tropical region, that the ground resource can rehabilitate fast enough within a short period of 48 days and still maintain an optimum yield in the fishery.

Regarding the rate of recuperation of the ground fishery, it appears from general observation that at most three to four years are necessary to rehabilitate, through regulated fishing activity, a given Philippine commercial fisheries resource. This has been apparently demonstrated in Manila Bay when trawling activity was limited to about ten vessels during the three years of Japanese occupation (1942–1944). This reduced trawling has almost completely rehabilitated the ground fishery in Manila Bay which was already badly depleted at the outbreak of the war in 1941. The catch has declined to about 200 to 280 kilograms per vessel per day. Immediately, after liberation in 1945, the catch increased to about four times the 1941 rate, it being from 800 to 1,200 kilograms per vessel per day.

TABLE 13.—*Number of draggers operating in Manila Bay indicating the normal catch of marketable fish per day and length of fishing trip.*

Year	Otter trawl	Beam trawl	Total	Normal catch per vessel per day		Length of fishing trip
				trays	*kilos*	*days*
1941		71	71	50–70	200– 280	1–2
1942–1944		15	15			
1945		2	2	200–300	800–1,200	1
1946	1	82	83	150–200	600– 800	1
1947	3	97	100	100–150	400– 600	1
1948	14	51	65	80–100	320– 400	1–2
1949	19	91	110	60– 80	240– 320	2
1950	48	84	132	40– 50	160– 240	2–3
1951	75	56	131	40– 50	160– 200	2–3
1952	64	35	99	30– 50	120– 200	3–4
1953	60		60	30– 50	120– 200	3–4

While there has been a steady over-all increase in the catch and number of trawlers in operation since 1946, the catch per unit of effort started to decline especially in Manila Bay (Table 13). According to later reports by operators (1952) the trawlers operating in Guimaras Strait gradually noted a decline in catch per day.

Prospects for the expansion of trawling by space and depth in Philippine waters are not very bright. Trawl explorations conducted jointly by the defunct U. S. Fish and Wildlife Service and the Bureau of Fisheries in 1948–1950 indicated that the assayed production of the remaining prospective areas within the 40-fathom line was about 50 kilograms per hour per drag with the use of a 100-foot net. There is an estimated 2,000 square miles of these seemingly prospective grounds, but most of these areas located on the southeastern part of Luzon are not readily accessible from the principal ports of Manila, Iloilo, and Cebu.

Expansion by depth beyond the existing 40-fathom line of commercial operation has also shown negative results as per the results of recent trawl explorations off Corregidor Island and Lingayen Gulf. The catch per hour of marketable fish seemed to decrease with increasing depth of water up to the 100-fathom line. It is of interest to note that the catch of nonmarketable fish which consists of flying gurnards. (Dactylopteridæ), stargazers (Uranoscopidæ), frog fishes (Ogocephalidæ), trumpet fishes (Fistulariidæ), and other worthless group of fishes appeared to increase in direct ratio with depth. Unlike, however, in the upper latitudes, the recent exploratory deep-water trawling operation up to 200 and 250 fathoms off the West Coast of the United States of America and along the English Channel has yielded very promising commercial catches of marketable species of fish.

The composition and size of the demersal stock of trawlable species are typically tropical, characterized by numerous species but generally lacking in poundage. The over-all production averaged about 68 kilos per hour-haul with the use of a 100-foot trawl net.

The present serious strain on the trawl fishery can be relieved in several ways. These are (1) diversion of some of the trawling fleet to pelagic fishing, (2) organization of high-sea trawling ventures along the South China Sea area, and (3) regulation of operating units per trawling area and rotation of trawling areas.

In the later part of 1950, from 10 to 20 per cent of the trawling fleet were diverted into the *basnig* fishery. This came in the wake of the successful development of the bag net (*basnig*) on board powered nonindigenous craft (65–130 feet long). This is one of the most outstanding developments in Philippine pelagic fisheries during the postliberation period.

The outlook of the Philippine trawl fishery is not entirely hopeless. The pre- and postwar successes of commercial and experimental trawling operations conducted by the Chinese fishermen from Hongkong and the Japanese fishermen from Southern Japan and Formosa in the South China Sea are highly indicative of the tremendous possibilities of developing an ocean trawl fishery from the Philippines. Some of the significant results of these oceanic fishing operations are shown in Tables 14, 15 and 16.

This venture will require specialized type of trawling vessels on entirely different rigging, large-sized meshes of nets and seasoned fishing crew that can withstand the exposed weather condition obtaining in the South China Sea area. The nearest oceanic trawling ground is about 400 to 500 miles of navigating distance from Manila, equivalent to about five days of navigation to and from the fishing ground. A normal fishing trip of 25 to 30 days can bring home a payload of from 50 to 60 tons of iced or refrigerated fish, good-sized marketable species which will find a ready acceptance in the Philippine markets.

The fishermen of neighboring nations have paved the way in ocean trawling and it remains for the Filipino fishermen to follow suit.

TABLE 14.—*Concentrated summer fishing grounds of South China Sea area.*[a]

Name of fishing ground	Chief variety of fish	Average catch per haul	Area in square nautical mile	Location
		box [b]		
A	Saurida	29.5	890	40 nautical miles south west of Taiwan Bank.
B	Taius, Lutianus, Saurida, Pristipomoides.	35.5	4,182	120 nautical miles southwest of Taiwan Bank
C	Saurida, Pristipomoides	32.3	2,335	Adjacent waters east of Hainan Island.

[a] Adopted from Liu-Foh-Hsuen and Chen Gen-Chen. Review on the several conditions of the trawling grounds of the South China Sea. 1952. Rep. Res. Lab. Taiwan Fish Rehab. Adv. No. 1.

[b] One box equals 25 kgm. (approximate)

TABLE 15.—*Concentrated winter fishing ground of South China Sea area.*[a]

Name of fishing ground	Chief variety of fish	Average catch per haul	Area in square nautical mile	Location
		box		
A	Saurida, Lethrinus	37.7	2,200	Adjacent deep waters south of Taiwan Bank.
B	Saurida, Lethrinus	34.8	600	50 nautical miles south of Swatow.
C	Saurida, Caranx	29.6	2,000	Adjacent deep and waters south of Swatow.
D	Gymnocranius, Pristipomoides.	34.1	2,800	Adjacent deep waters south of Hongkong.
E	Pristipomoides	41.6	240	170 nautical miles WSW of Hongkong.
F	Pristipomoides, Gymnocranius, Caranx	27.4	960	Adjacent waters north of fishing ground E.
G	Saurida, Lutjanus	32.6	2,000	Adjacent waters east of Hainan Island.

[a] Adopted from Liu Foh-Hsuen and Chen Gen-Chen. Review on the several conditions of the trawling grounds of the South China Sea. 1952. Rep. Res. Lab. Taiwan Fish Rehab. Adv. No. 1.

TABLE 16.—*Distribution and weight of the commercial species taken in oceanic trawling along South China Sea.*[a]

Scientific name	Weight		Fishing area	Remarks
	Range	Maximum weight		
	grams	*Kgm.*		
Red Sea Bream, *Taius tunifrons*, Sparidae	500– 600	2	South of Hongkong and Macao; SW of Taiwan.	Young fishes were found.
Lizard fish, *Saurida argyrophares*, Synodontidae	500– 600	1.5	South of Swatow, Taiwan Bank, E of Hainan.	Large ones weigh 2 kgs. each. Mostly medium size and fatter in winter.
White snapper, *Gymnocranius griseus*, Lutianidae	600– 900	1.5	South of Hongkong	Large ones weigh 1.5 kgs. each. Mostly medium size and fatter in winter.
Red snapper, *Lutjanus dodecacanthus*, Lutianidae	2,000–2,500	2.6	SouthWest of Taiwan Bank	Summer weight around 2 kgs. Larger in winter. Average weight is around 2.6 kgs.
Nakaski snapper, *Pristipomoides sparus*, Lutianidae.	2,000–2,500	5	SSW and N of Hongkong	Mostly around 2 kgs. Large ones weigh 5 kgs. each. Fatter in winter.
Carangoid, *Caranx malabaricus*, Carangidae	200– 400	1	South of Swatow, SSW of Hongkong	Large ones over 1 kg. each, but very few. Mostly medium size and fatter in winter.
Shark, *Hemigaleus balifouri*, Carchariindae	1,000–2,000	4	SE of continental shelf at deeper areas	Large ones weigh 4 kgs. each. Mostly medium size and fatter in winter.
Porgy, *Lethrinus haematopterus* Sparidae	1,000–2,000	2	South of Taiwan Bank; South of Swatow.	Large ones weigh 2 kgs. each. Mostly medium size and fatter in winter.
Sea bass, *Epinephelus fasciatus*, Serranidae	500–3,000	4	South of Hongkong	Generally 500 grams in summer and 3 kgs. in winter. Large ones weigh 4 kgs. each.
Golden skin Pargo, *Argyrops cardinalis*, Sparidae	500–1,000	1	West of Hongkong	Generally 500 grams. Large ones weigh 1 kg. each. Fatter in winter.

[a] Adopted from Liu-Foh-Hsuen and Chen Gen-Chen. Review on the several conditions of the trawling grounds of the South China Sea, 1952. Rep. Res. Lab. Taiwan Fish Rehab. Adm. No. 1

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TERMINOLOGY

Body *(katawan)*—refers to the top and tapered part of the trawl, extending from base of the two wings to forward attachment of bag.

Bag, tail or cod end *(supot)*—refers to the slightly tapered or untapered heavy portion of the net which holds the catch during fishing.

Belly *(tian)*—the bottom heavy portion of the body of the net which glides over the ground during fishing.

Bosom *(garganta)*—the forward part of the belly made of about a meter strip of coarse and heavy webbing which serves as a rubbing piece of net.

Otter board, otter door (board or *tabla)*—refers to the pair of rectangular wooden paravanes used to spread the wings and mouth of the trawl net during fishing.

Chains *(kadena)*—refer to chain weights used along the footrope and bridles of the otter door.

Brail *(baras)*—refers to a wooden stick used to spread the wing tips.

Mouth *(bukana)*—refers to the forward opening between the cork and leadlines.

Footrope, leadline, bottom line, ground line *(lawayan sa bato)*—is the part to which the bottom part of the net is hung from wing to wing.

Headrope, corkline, floatline *(lawayan sa buya)*—refers to the upper ropes on which the upper part of the net is hung from wing to wing.

Chafing gear *(panapis)*—is a piece of coarse abaca webbing or old netting attached to the bottom rubbing portion of the bag.

Shark or purpoise covers *(pamating)*—consists of a coarse abaca or old netting completely encircling the bag. This is to protect the bag from the attack of sharks and purpoises on the impounded and gilled fish.

Top *(tenjo)*—the forward part of the body of the net which overhangs between the bases of the wings.

Wings *(pakpak)*—are the extended narrow sides of the net, tapered along the top side and straight along the bottom side.

Tips, corners or bats *(kutsilyada)*—are triangular pieces of webbing attached along the forward edge of the body on either side with an outer edge sewed to the wings.

Trawl, warp, towline *(remorke)*—consists of a pair of Manila ropes or steel cables used in towing the net during fishing.

Sides and top—are the sides of the body of a four-sided net.

Flapper, funnel *(galao)*—is a non-return value which consists of either one or four sides of light netting set. This serves in the pre-sack, as a one-way value to prevent the escape of fishes toward the mouth of the net.

Big balk line *(sumberihan)*—is the secondary foot-roof of small stuff Manila rope to which the small balk line is tucked in.

Small balk line *(sumbiri)*—consists of a single scan of lacing on the big balk-line.

A lacing line *(panumbiri)*—laces the footrope to the marginal line of the net proper. The marginal line is seized at definite interval along the hanging line of the net.

Wing bridle *(parisukat sa pakpak)*—is a pair of forked ropes about the size of the footrope attached to the wing tips.

Sides *(tagiliran)*—The lateral part on each side of the body of the net.

Sweeprope, ground cables *(parisukat sa board)*—refers to the rope or cable connecting the otter door and the wings.

Bag line, haul-in-line *(ayuda sa supot)*—is a Manila rope towline used in hauling the bag, often secured to the forward part of the net.

Quarter rope ***(ayuda sa lawayan)***—is a line temporarily secured on each side of the junction point between the bosom and the wing to the fore part of the sweeprope. This is to facilitate hauling of the net.

Guide rope ***(seguiri)***—is used to help guide or steer the vessel as well as secure the towline from fouling under the vessel.

Brailing frame ***(salokan)***—is the scooping platform of the catch.

T-frame, stern davits ***(saklitan sa board)***—are hanging gallows of the otter doors set at the port and starboard quarter (stern set).

Rope penant, board penant ***(ayuda sa parisukat)***—is a piece of rope secured between the board bridle and the forward end of the sweeprope. This aids in retrieving the sweeprope during hauling operation.

Poke line, draw string ***(panali sa supot)***—a piece of hard cord rope used in tying the poke end of the bag.

Snagline ***(panabit)***—is a line attached between aft corners of each otter door or the focal center of each board. This is used as a protecting line of the net in fishing in new grounds.

Shooting the net ***(areada)***—is the paying out of the net at the commencement of fishing operation.

Hauling the net ***(kobrada)***—is the taking in of the net aboard the vessel after completion of dragging operation.

Drag, haul ***(kobrada)***—the period covered between shooting and hauling in of the net (actual fishing operation).

Focal center—The properly adjusted towing point of the otter board.

LIST OF MATERIALS NEEDED FOR MAKING A TYPICAL 120-FOOT OTTER TRAWL NET

For net:

Twine for making web:

25 kgm. No. 12 medium laid down twine—Wings (*Pakpak*).
25 kgm. No. 15 medium laid cotton twine—Body (*Katawan*).
5 kgm. No. 60 medium laid cotton twine—Belly (*Paniyan*).
10 kgm. No. 18 medium laid cotton twine—Bag (*Supot*).
2 kgm. No. 12 medium laid cotton twine—Lacing twine (*Panutos*).
2 kgm. No. 90 medium laid cotton twine—Hanging twine (*Panuhog*).

Cotton rope:

15 kgm. cotton rope, ½" diameter—Ribbing (*Pangbuto*).
Poke line (*Tali sa supot*).

Manila rope:

120 fathoms (225 meters) 1" diameter—Headrope (*Lawayan sa buya*).
Sweeprope line (*Parisukat*).
Door strap (*Lubid sa tabla*).

120 fathoms (225 meters, 1 roll) 12 thread—Hanging line (*Panuhog*).
(⅜" diameter)
Small balk line (*Panumbiri*).
Buoy line (*Pangbuya*).

25 fathoms, 1½″ diameter—Footrope (*Lawayan sa bato*).
2 balls, 6 thread (¼″ diameter, 3 ply)—Glass buoy cover (*Balot sa buya*).

Net accessory:

100 each glass floats, 4″ diameter (*Buya*).
20 each glass floats 6″ diameter (*Buya*).
120 each rock weight (Nos. 1, 2, and 3)—(*Bato*).
12 each 2″ diameter galvanized iron rings (*Argolla*).
2 each 2½″ x 2″ x 3′ wing brail—(*Baras*).
30 kg. galvanized iron chain, ⅜″ size (*cadena*).
12 each galvanized iron thimbles, 1″ size—(*Guarda acabo*).
6 each galvanized iron shackles ⅝″ size (*rollete*).

For paired otter doors (1½″ × 36″ 6′).
Approximate weight: 250 lbs. each.

Lumber:

36 bd. ft. of soft wood (*palosapis*) planking (1½″ x 12′ x 6′).
18 bd. ft. of hard wood (*guijo*) planking (1½″ x 12″ x 6′).
13.5 bd. ft. of hard wood (*guijo*) planking (1½″ x 6″ x 12′).

Iron runner and accessory:

140 lbs. (65 kgm.) iron runner (4 pieces of ½″ x 4″ x 6′ each).
18 feet (5 meters) galvanized iron chains ⅜″ diameter.
72 each bolts, ⅜″ x 3″.
6 each galvanized swivel, ⅝″ diameter.
4 each eye bolts with washers, ½″ x 2″.
2 each galvanized swivels, ⅝″ size.
2 each triangular (equilateral) bridles, 24″ x ⅜″.
4 each iron bridle plates, ¼″ x 4″ x 8″.

Prospectus for a Small Otter Trawler
(25 tons gross)

I. Probable capitalization	₱40,000.00
1. Equipment:	
a. One wooden vessel, reconditioned tugboat. (46′ x 14′ x 5′) equipped with one 120 h.p. Cummins or a 225 h.p. Graymarine Diesel	25,000.00
NOTE.—New vessel of this size equipped with a 120 h.p. heavy duty engine complete with fittings	(30,000.00)
b. Reconversion of vessel for otter trawl, including insulation of fish hold	2,000.00
c. Three (3) sets of otter trawl nets, complete with accessory gear at ₱1,200 each	3,000.00
d. Winch installation (roller type)	800.00
e. One pair otter doors	200.00
f. One pair trawl warps 1⅛″ diameter, hand laid Manila rope	400.00
g. Boat chandleries	150.00
h. One service jeep (used)	2,000.00
i. Miscellaneous supplies	100.00
2. Operating capital	5,750.00
	₱40,000.00

II. Probable monthly income (26 days operation in Lingayen Gulf).

1. Income, based on number of fish trays (4 kgms each)
   a. At 60 trays daily average catch or 1,680 trays monthly at ₱4 each ..... ₱6,720.00
   NOTE.—60 trays of assorted fish is the current average daily catch of a small otter trawler in Lingayen Gulf (July, 1949).
2. Probable net income monthly 2,035.00
3. Estimated monthly operating expenses 4,695.00
4. Estimated daily operating expenses 156.00

III. Monthly operating expenses (26 days operation)

1. Salaries and/or wages of crew:
   a. One skipper (*patron*) ..... ₱250.00
   b. One engineer (Bay and river license) 250.00
   c. One master fisherman at ₱10 daily 260.00
   d. One 2nd master fisherman at ₱8 daily 208.00
   e. Three deck hands at ₱4 daily 312.00
   f. One cook at ₱4 daily 104.00

   Total ..... ₱1,384.00

2. Monthly maintenance of boat and crew:
   a. Subsistence of crew at ₱15 daily ..... ₱450.00
   b. Ice, 6 blocks (50 lbs) daily at ₱2.50 each 390.00
   c. Fuel, 38 drums at ₱22 each 836.00
   d. Lubricating oil, greases, etc. 100.00
   e. Gasoline 100.00
   f. Miscellaneous 50.00

   Total ..... ₱1,926.00

3. Monthly salaries of management:
   a. One in-charge (*encargado*) ..... ₱200.00
   b. One accountant (part-time) 50.00
   c. One net mender 150.00
   d. Two helpers at ₱100 each 200.00
   e. One driver 160.00

   Total ..... ₱760.00

4. Monthly repair and depreciation of hull; engine and gear:
   a. Engine depreciation and repair (10%) ..... ₱200.00
   b. Hull dry docking and painting every 6 months including depreciation 150.00
   c. Abaca trawl warp depreciation (20%) 75.00
   d. Depreciation and repair of nets (5%) 200.00

   Total ..... ₱625.00

ILLUSTRATIONS

Plate 1

Fig. 1. General view of commercial otter trawlers anchored off Navotas Fish Landing, Navotas, Rizal.
2. A typical Manila Bay trawler (converted Japanese-type utase trawler) Navotas, Rizal.
3. A typical dugout banca used in ferrying provisions to and from anchored trawlers, Navotas Fish Landing, Navotas, Rizal.

Plate 2

Fig. 1. Concrete vat used in tanning trawl nets, Navotas, Rizal.
2. Tanned trawl net being hanged to dry, Navotas, Rizal.
3. Iced fish is galvanized iron containers (*banyeras*) used by "outsided" trawlers for storing and transporting catch.

Plate 3

Fig. 1. Trash catch (*jako*) of trawlers contained in bamboo baskets.
2. Files of fish trays (*caja*) ready for delivery to "inside" trawlers.
3. Files of galvanized iron fish containers (*banyera*) ready for delivery to outside trawlers.

Plate 4

Fig. 1. Amphibian truck (DUKW) loaded with ice and supplies for delivery to anchored trawlers.
2. Unloading *banyera* containing iced fish from amphibian truck.
3. Fish trays (*caja*) ready for wholesale bidding.

Plate 5

Fig. 1. Strapping the wings from a single block and tackle rigged to a boom on a modern trawler.
2. Surfacing the bag containing the catch.
3. Hoisting the bag.
4. Centering the loaded bag on the aft deck to release catch.
5. Removing strap on the wings of the net.
6. Releasing the cod-end knot.
7. Fish catch of a trawler released on the deck.
8. Sorting the catch.

Plate 6

Fig. 1. A medium-sized trawler (Manila Bay type).
2. A medium-sized trawler (Negros type) Bacolod, Negros.
3. A small-sized trawler, Tabaco, Albay.
4. A baby type trawler (a converted harbor launch).
5. Deck of a modern medium trawler looking from aft showing port and starboard trawling winches. Note steel wire warps being released.

6. Paying-out an otter trawl net astern.
7. Securing the port side otter door on the A-frame made of heavy duty G.I. water pipe.
8. Hooking the port side otter door preparatory to hauling of net.

PLATE 7

FIG. 1. Hauling-in starboard side trawl warps on winch rollers.
2. Hauling-in of quarter ropes.
3. Brailing the catch over a U-shaped, collapsible frame, placed squarely aft the stern railing.
4. Preparing the cod-end for brailing.
5. Paying out the trawl net over the stern.
6. Releasing the port-side trawl warp through the two forward towing bitts.
7. Stretching the wings during shooting of the net.
8. Securing the trawl warps on the port side forward bitts.

PLATE 8

FIG. 1. A U. S. Navy personnel boat being converted to a small trawler. Note the completed pilot house and sidings.
2. A medium trawler being dry-docked for annual repairs of hull and underwater parts.
3. A U. S. Navy steel boat under conversion to a medium otter trawler.
4. T. N. Gill used in otter trawl exploration by the U. S. Fish and Wildlife Service in the Philippines (1948–50).
5. Otter trawler under repair.
6. Native spining machine for cotton and abaca twines, Tabaco, Albay.

FIGS. 7–8. Native twine making machine, Tabaco, Albay.

PLATE 9

FIG. 1. Hauling the main trawl warp of the Japanese utase (beam trawl) through block fairleads secured at the base of forward mast. After Umali (1932).
2. Securing the main bridles preparatory to hauling of the utase net. After Umali (1934).
3. Hauling in the wing bridles from portside winch rollers. After Umali (1932).

PLATE 10

FIG. 1. Securing the cod-end with a Japanese knot preparatory to shooting the utase net. After Umali (1932).
2. Repairing torn parts of bag of net and checking rock and chain weights. After Umali (1932).
3. Hauling in manually the wing of an utase net. After Umali (1932).

PLATE 11

FIG. 1. Net loft of pre-war Japanese utase operators, Bankusay Manila. Note tanning vats, fish trays and spare beams in foreground

and nets hang out to dry in the background. After Umali (1932).

2. Utase beam trawler anchored off Bankusay Fish Landing, Manila. Note: Utase nets being dried on deck and file of trays in the background.

TEXT FIGURES

FIG. 1. Trawling grounds in the Philippines. Heavily shaded areas indicate existing commercial grounds and those lightly shaded are possibly potential trawling grounds.
2. Deck plan of a typical Philippine otter trawler (diagrammatic).
3. T-stanchions and brailing frames of a Philippine otter trawler (diagrammatic).
3*a*. Stern davit and trawling block.
4. Deck arrangements on small trawling vessels (under 50 feet long) usually adopted in the Gulf State of the United States of America (diagrammatic).
5. Deck arrangements on large trawling vessels (over 50 feet long) usually adopted in the Pacific Coast of the United States of America (diagrammatic).
6. Trawl warps and bridle connections, Philippine otter trawler (diagrammatic).
7. The Philippine otter trawl door used in the commercial fishery (diagrammatic).
8. Diagram of a commercially operated otter door showing the percentage proportions of the bridle arrangement.
9. Diagram of a Louisiana-type of otter door (light type) suitable for a 70-foot headrope net. Each weighs approximately 35 kgs.
10. Diagram of a Western type of otter door (medium heavy type) used in deep-water otter trawl exploration in the Philippines. Each weighs approximately 250 kgs.
11. Systems of otter door hook-ups used in the commercial otter trawl fishery (diagrammatic).
12. Perspective view of a typical trawl net showing parts (diagrammatic).
13. Diagram of a typical Philippine trawl net (diagrammatic).
14. The "mestizo" trawl net (diagrammatic).
15. Cutting diagram of a Florida baloon trawl.
16. The shooting operation of the Philippine otter trawl net (diagrammatic).
17. The hauling operation of the Philippine otter trawl net (diagrammatic).
18. The shooting operation of an utase trawl gear (diagrammatic).
19. Hauling operation of a Japanese beam trawl gear, *utase* (diagrammatic).
20. A typical Japanese beam trawler, *utase*, deck plan; *b*, bowsprit; *c*, cabin; *e*, engine room; *ex*. exhaust; *fw*, fresh-water tank; *g*, galley; *h*, hatch cover; *mm*, main mast; *mw*, motor winch; *pp*, wooden pins on the port side; *ps*, wooden pins on the

starboard sides; *rb*, roller toward bow; *rw*, roller winch; *sd*, small derrick; *st*, store box for provisions; *wb*, wooden bar; *wh*, wheelhouse.

21. Perspective view of an utase trawl net showing important parts: *b*, beam; *bl*, belly; *br*, brail; *bt*, bating; *c*, cod end or bag; *d*, draw string, or poke line; *f*, funnel-like affairs; *fr*, footrope; *gf*, glass floats; *hr*, headrope; *iw*, iron-chain weights; *mb*, main bridle; *rw*, rock weight; *s*, square, *sw*, stone weights; *w*, wing; *wb*, wing bridle.
22. An utase trawl net; end of one wing, showing various parts and accessories and its attachment to wing and main bridles; *bl*, balk line; *br*, brail; *fr*, footrope; *gf*, glass float; *hr*, headrope; *ic*, iron-chain weights; *jk*, Japanese knot; *mb*, main bridle; *rw*, rock weight; *sw*, stone weight; *wb*, wing bridle.
23. A portion of an utase trawl warp, showing connection of main towline, iron chain, and main bridle; *emb*, eye-splice and thimble of main bridle; *emt*, eye-splice and thimble of main towline; *ic*, iron chain; *mb*, main bridle; *mt*, main towline.
24. Forewing showing head and footrope connection and details.
25. V–D links and connections.

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PLATE 1.

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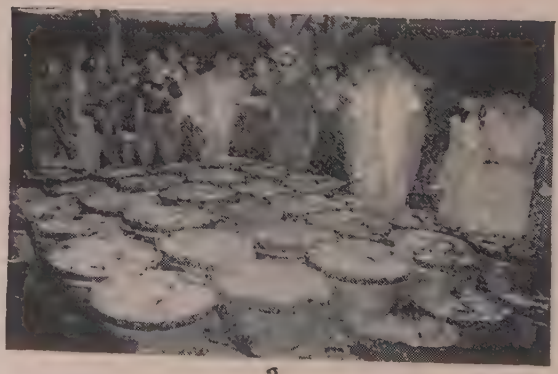

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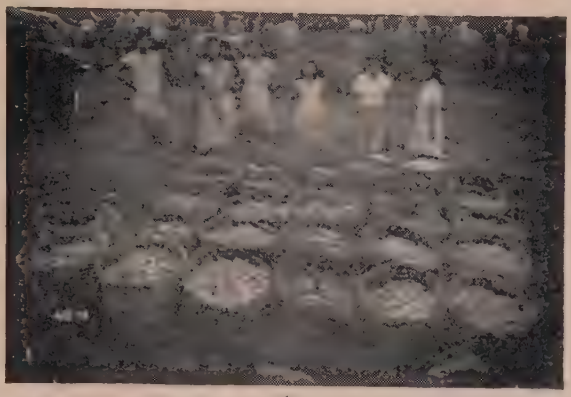

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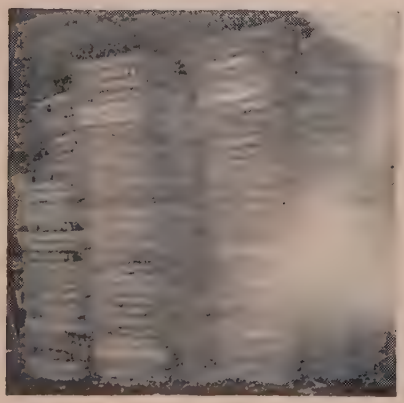

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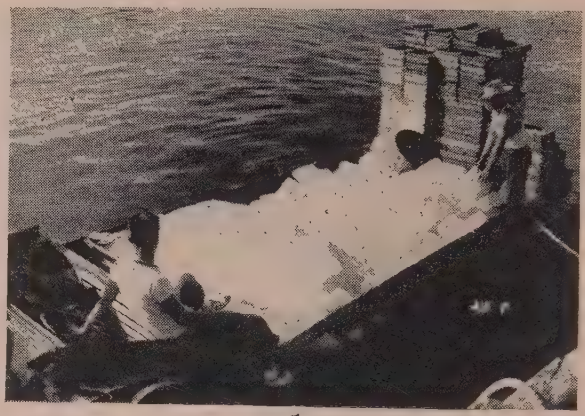

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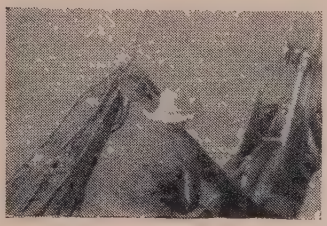

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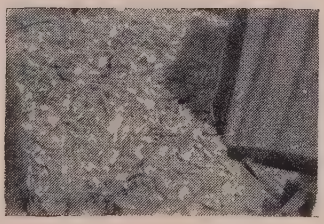

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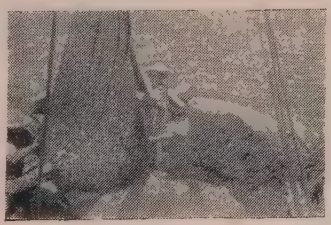

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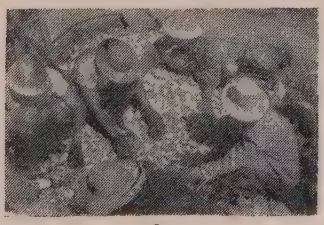

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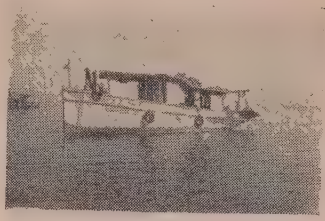

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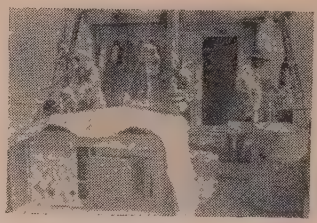

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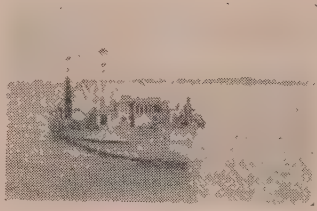

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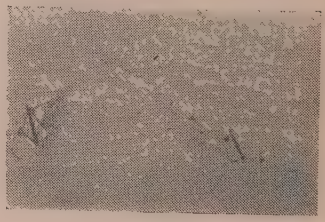

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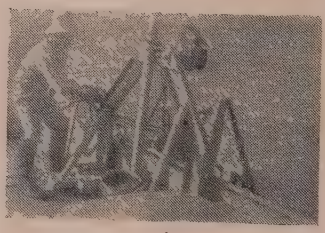

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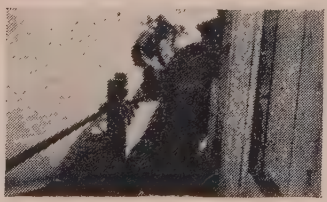

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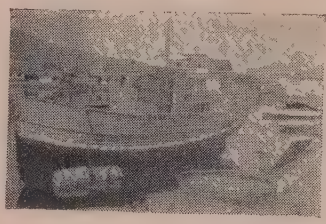

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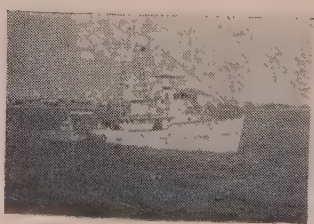

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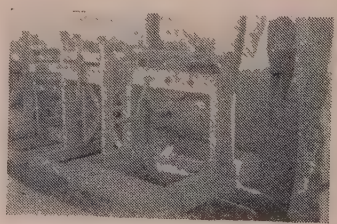

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